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THE MILLING AND BAKING QUALITIES OF VICTORIAN WHEAT.

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I.—Introduction.

In the pioneering stages of the wheat industry in Australia it was only natural to expect that the pioneers, owing primarily to the relative scarcity of labour and capital, on the one hand, and the relative cheapness of virgin land on the other, would adopt extensive methods of culture, in which large acreages were annually cropped and small average yields obtained. As the industry developed, local production soon overtook local consumption, and the necessity thus arose for the exportation of the surplus. The prices of the commodity came to be governed by the world's markets, and, through the stress of outside competition, the rise in local land values, and a falling off in soil fertility, the necessity for more intense methods of culture became obvious. The result was reflected in the vastly improved methods of wheat growing adopted during the last decade, and a series of large harvests.

But while our wheat growers have made great advances in the adoption of up-to-date machinery, improved methods of cultivation, soil fertilization, and crop rotation—it is a matter for regret that the methods of marketing and financing the crop are the same as those in vogue when the industry was in its infancy. Wheat is still sold on the f.a.q. basis, a system which gives the grower no encouragement to produce a prime product, or to trouble about such questions as the milling quality of the grain he raises.

The recent report of the Royal Commission on the marketing of wheat very forcefully pointed out the manifold objections of the existing system of marketing, and strongly advocated, coincident with the

installation of bulk handling, the adoption of four permanent grades for standards of quality, namely, (1) hard milling wheats, (2) No. 1 export, (3) No. 2 export, and (4) wheat of no grade.

It would appear with every natural product exported, save wheat, the question of quality is a paramount factor in the determination of the market price. The value of butter, lamb carcases, and fruit is determined by their quality, and, consequently, these products are regularly and systematically graded for export. With wheat, however, the man who produces a prime product does not ordinarily receive any more than the grower who is indifferent or careless in the preparation of the sample.

That this system of marketing is most unsatisfactory must be obvious to the most casual observer, and until some system of grading Australian wheat according to quality is permanently adopted, the wheat will not realize that high price in the world's markets to which its specific qualities entitle it.

The immediate result of the f.a.q. system of marketing is that the farmer's attention has been concentrated solely on those varieties of wheat which give him heavy yields per acre, irrespective of the quality of the grain. The result has been that the growing of varieties of wheat of high milling and baking quality has been neglected, partly because these varieties are generally less prolific and partly because insufficient encouragement has been given by the trade for the production of these high quality wheats. The attitude of the farmer is, of course, perfectly rational; as, while existing conditions of marketing continue, it is idle to expect him to grow any other than the most prolific varieties of wheat. His ideal variety of wheat must, therefore, be the prolific variety—one which will fill the bag. The miller, on the other hand, prefers those varieties which will mill readily and yield on milling a high percentage of flour of good colour, since the greater the yield of flour of quality in comparison with the offal, the greater will be his profits.

The ideal variety for the baker is one which yields a flour of high strength, *i.e.*, a flour which will yield a maximum of well-piled loaves of bread of good colour, texture, and quality per sack of flour.

The wheat breeder's ideal is to produce a variety which will completely satisfy the farmer, the miller, and the baker, and the problem in all countries where wheat breeding is actively carried on is to produce varieties which are prolific, and which on milling yield a high percentage of flour of good colour, high strength gluten content, and of good baking quality. It is commonly supposed that prolificacy and quality in wheat are necessarily opposed—that it is not possible to combine in the one variety high yielding capacity and high milling and baking quality. This impression has probably gained ground because varieties of high milling quality at present grown in Australia are frequently poor croppers. But in the Red Fife wheat—the Hard Red of Manitoba—we have an instance of a variety which is the best yielder in several Canadian provinces, and withal a wheat of excellent milling and baking quality. The home-grown wheats of England are invariably soft, white, of low strength, and, in comparison with foreign

wheats, sell at reduced rates. Biffen, of Cambridge, has produced a cross-bred variety, which, grown in England, is not only as prolific as ordinary English wheats, but has a strength nearly equal to the best Manitoban wheat.

Can High Strength Wheats be Produced in Australia?

It was formerly thought that wheats of exceptional strength could not be produced under Australian skies—that there was something in our climate which prevented locally-grown wheats from rising beyond a certain measure of strength and gluten content. A considerable amount of work has been done on the influence of climate on the composition of wheat, and it will be necessary in subsequent articles to review this matter in considerable detail. It is only necessary to point out here that while the quality of the grain is in a large measure dependent on the climate, it is also an inherent characteristic of the

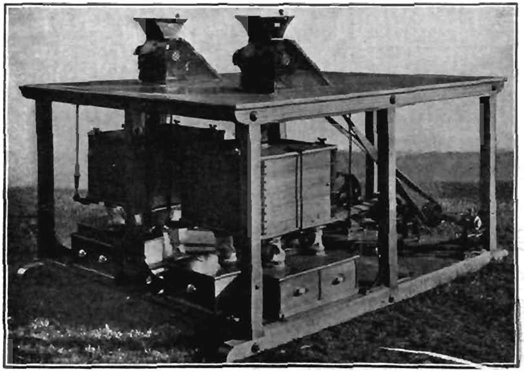


Fig. 1.—The Mill.

variety. Varieties have, indeed, been evolved under Australian conditions by the late Mr. Farrer, of New South Wales, which are equal in milling quality to any wheats in the world. Unfortunately, as already indicated, these varieties generally give indifferent yields when grown in the field. They are, therefore, not popular with farmers. A great advance will be made when Australian varieties of wheat are evolved which will combine high yielding capacity with high milling and baking quality.

In the evolution of such wheats the experimental flour-mill and baking oven will be of invaluable assistance. In the work of wheat improvement they form the natural complement of the experimental field plot. The field plots enable comparisons to be made of the relative prolificacy of different varieties under identical soil conditions. The experimental flour-mill provides exact information regarding the

milling qualities of the different varieties, whilst the experimental baking oven enables judgments to be passed on the value of the flour for bread-making purposes.

Departmental Flour-mill.

During the past year a small milling plant and an electric baking oven have been installed in the Department for the purpose of conducting milling and baking tests with Victorian wheats and flours. Similar mills have been in operation in New South Wales, Queensland, South Australia, and Western Australia for some years past. The primary purpose of these mills has been to assist in the work of wheat improvement. The systematic improvement of wheat in milling and baking quality by any of the recognised methods of breeding would be incredibly laborious without the assistance of such an experimental mill. Such improvement would necessitate the separation and culture of each strain or variation in any cross-bred until sufficient quantities of wheat accumulated to perform a milling test in an ordinary mill. With this specially constructed experimental flour-mill as small a quantity as 1 lb. of wheat can be used for a milling test, and the work of improvement thus shortened at least two to three years. It thus becomes possible to readily eliminate among a group of new varieties of equal prolificacy, those strains which are wanting in milling excellence. Apart from its use to the wheat breeder, these mills are of service to millers, the wheat grower, and the shipper.

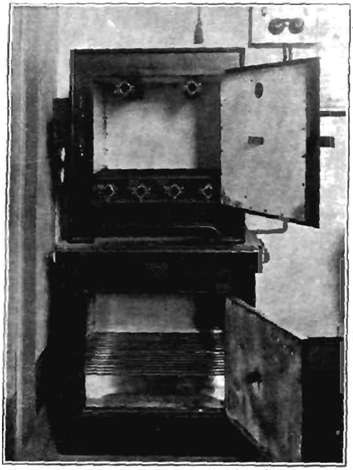


Fig. 2.—Electric Baking Oven.

Repeated tests have demonstrated that these small experimental mills will give as accurate an indication of the milling quality of the flour from 1 lb. of wheat as can be obtained in a commercial mill from the milling of 40 bags of wheat.*

Moreover, the milling products obtained from the experimental mill from a given sample of wheat are practically identical with those obtained from a commercial mill. That they are of service to the

* *Vide* "Milling Experiments," Bulletin No. 52, South Australian Department of Agriculture.

miller is indicated by the fact that many milling firms in America and on the Continent have installed these small mills, and systematically and thoroughly test various parcels of grain before running the wheat through the ordinary mill. The wheat grower may get information as to the milling quality of his wheat and probable value of such grain to the miller. Also the mill will be of service in connexion with the adjudication of wheats entered for competition at agricultural shows. For many years past, the wheats competing for prizes at Sydney and Adelaide Royal Shows have been tested on the departmental mills, and points awarded for such definite qualities as ease of milling, percentages of milling products, colour, strength, and gluten content of the flour.

The electric baking oven enables the flour tests to be carried out still more extensively, and provides exact information regarding the quality of the bread that can be made from a given sample of flour, and the colour, volume, texture, and quality of the loaf.

During the present year some investigations relating to the milling and baking qualities of some of the more commonly grown varieties of wheat have been made, the results of which will be made available from time to time in this *Journal*. Much of the work done has been of a preliminary character, but it is proposed, immediately after the coming harvest, to make a systematic examination of the chemical and milling qualities of the wheat grown in each of the wheat districts of the State. Up to the present, the work has been confined to two centres, Longerenong in the Wimmera, and Rutherglen in the north-east. Before consideration is given to any results, and by way of prelude to future discussions, it will be necessary to review very briefly the structure of a grain of wheat, the chemical composition of the grain, what constitutes milling and baking quality in wheat and flour, and the principles involved in the milling of wheat and baking of bread.

Structure of the Grain.

A grain of wheat is composed of three distinct parts—

(*a*) Protective covering.
(*b*) Germ or embryo.
(*c*) The endosperm.

The protective covering consists of a series of more or less well defined layers, at least five in number (Fig. 3). These various coats or layers serve as a protection for the germ and endosperm. In the process of milling they become detached from the remainder of the kernel, and collectively form the bran. The most important of the various layers in the protective coat is the aleurone layer, which consists (Fig. 3) of large more or less rectangular cells, with thick cell walls containing oil and granular nitrogenous matter. It is frequently called the gluten layer, though this is a misnomer, as the gluten found in the flour is derived from the starch cells of the endosperm, and not the aleurone layer.

The Germ or Embryo is situated at the end opposite the brush, and is the portion of grain destined to form the future wheat plant. It is rich in protein, fat, and oil, and contains but little starch.

Opinions differ as to whether or not the germ should be removed from the flour; but the balance of evidence is in favour of its removal. The presence of the germ tends to discolour the flour, and the high percentage of oil and protein tend to impair the keeping quality, and develop rancidity, and it is therefore generally removed in the process of milling.

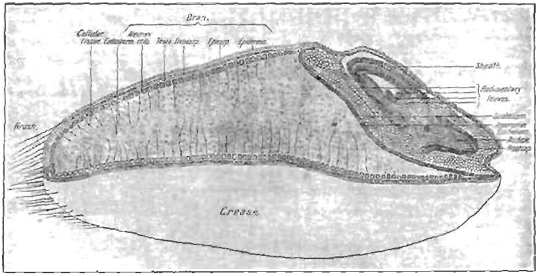


Photo., [C. C. Brittlebank.

Fig. 3.—Longitudinal Section of a Grain of Wheat, showing the internal structure.

The Endosperm.—This occupies from 75 to 80 per cent. of the kernel. It acts as a storehouse of food for the young plant during the time it is seeking to establish itself in the soil. It is composed principally of starch cells, large elongated cells, with their long diameters arranged radially to the surface of the wheat berry. The starch cells consist of an outer covering of cellulose, containing numerous starch grains and a considerable amount of gluten. It is the endosperm which forms the flour in the process of milling.

Chemical Composition of Wheat.

A grain of wheat consists of a number of ingredients of varied chemical composition. For convenience, these ingredients are generally arranged in six groups, as follow:—

Moisture,
Protein,
Crude fibre,
Ether extract,
Nitrogen free extract, and
Ash.

A representative sample of Victorian wheat (f.a.q. sample, 1911-12) gives the following analysis:—

	Per cent.
Moisture	10.43
Protein	11.26
Crude fibre	2.32
Nitrogen free extract	71.97
Ether extract	2.79
. ..	1.23

When wheat is heated in an oven at a temperature of boiling water, it loses weight. This loss of weight represents the moisture. If the dried portion be further heated to dull redness in a current of air, a small whitish residue remains—the ash—whilst the portion incinerated is the organic matter. This organic matter, which constitutes the greater portion of the grain, may be divided into two groups—

(*a*) Nitrogenous, represented in the above analysis as protein.
(*b*) Non-nitrogenous, including the fat or ether extract, carbohydrates or nitrogen free extract, and crude fibre.

These proximate constituents may now be considered *seriatim*.

Water.—The amount of water present in wheat varies considerably, according to the district in which it is produced. Generally speaking, the lower the percentage of moisture the better the quality of the wheat. A high percentage of moisture in a wheat is objectionable, because it not only leads to loss in weight of the mill products, but also tends to make the flour unstable and liable to fermentation.

Protein.—The most important constituent in the grain is the protein. It is the ingredient responsible for the repair of muscular tissue. The proteins are complex bodies, and vary in their chemical properties. Typical proteins are white of egg, casein, and gluten of wheat. The proteins contain on an average 16 per cent. of nitrogen. The quantity of crude protein present in a wheat is therefore obtained by multiplying the percentage of nitrogen by 6.25. Besides the proteins, there is always a small amount of non-protein matter in the grain. The amount, however, is so small that it may be considered a negligible quantity as far as comparative examinations are concerned. The non-proteins are called amides or amino-compounds, and they are generally found in greatest quantity in young, immature plants. The most important of the proteins in wheat is gluten, the name given to the sticky-elastic mass obtained when dough is kneaded in a stream of water until the whole of the starch is removed. The gluten is really composed of two proteins—gliadin, soluble in a 70 per cent. alcoholic solution, and glutenin, which is insoluble. Besides these proteins, three others have been isolated, leucosin and proteose, soluble in water, and edestin, soluble in a 10 per cent. salt solution. According to Osborne and Voorhees,* the relative amount of the various proteins in the wheat kernel are as follow:—

	Per cent.
Leucosin	0.3-0.4
Proteose	0.3
Edestin	0.6-0.7
Glutenin } Gliadin }	9.50

Ether Extract.—This extract contains not only the fat, but also all the other matter soluble in sulphuric ether. In wheat, the extract is practically pure fat. It is of a light yellow colour, darkening on exposure to air. This fat is liable to become rancid on keeping, hence the necessity for the removal of the germ which is rich in fat, from the flour. The fat consists of several fatty acids, principally oleic, in combination with glycerine, as glycerides. Like the carbohydrates it is composed of carbon, hydrogen, and oxygen, but it contains a much

* Osborne and Voorhees—*American Chemical Journal*, Vol. vi.

higher percentage of carbon than the carbohydrates. When burned, it gives two and a half times as much heat.

Carbohydrates.—These include crude fibre and nitrogen free extract. They contain, among other substances, the following:—starch, sugar, dextrin, cellulose, pentosans, &c.

The crude fibre is that portion of the wheat which resists the solvent action of a weak boiling solution of—first, sulphuric acid, and afterwards, weak caustic soda. The residue remaining undissolved consists of a mixture of cellulose, pentosans, and lignin.

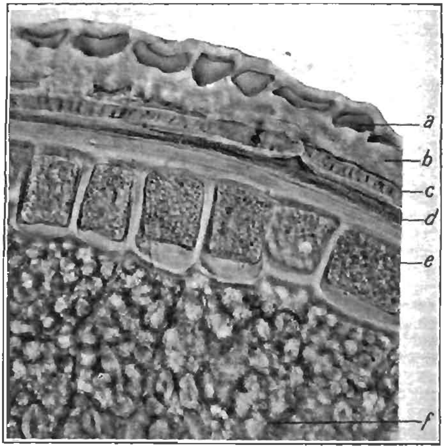


Fig. 4.—Transverse Section of Federation Wheat. x 400, Showing Structure of Protective Coats and Endosperm.

(a) Epidermis; (b) Epicarp; (c) Endocarp; (d) Testa; (e) Aleurone layer; (f) Endosperm.

Cellulose is closely related to starch, and can be found almost pure in cotton-wool after the fat has been extracted from it. The lignin is of a more woody nature, and forms the greater part of the outer cell walls of the berry. The cellulose is that portion which encloses the starch and aleurone cells, and is the material which gives form and structure to the plant tissue. Pentosans aid the cellulose in giving substance to the plant tissues. They differ from cellulose in being soluble in dilute acids. They are so called because they yield a sugar containing only five atoms of carbon to the molecule. They are rendered soluble by the digestive fluid, and can be utilized as food.

The nitrogen free extract.—This includes all the other constituents not included in the other groups. Owing to the number, and all possessing more or less the same chemical characteristics, they are generally determined by difference. This group includes all the

carbohydrates other than those mentioned under the crude fibre group. The term carbohydrates is applied to a class of bodies composed of carbon, hydrogen, and oxygen, which contain twice as many hydrogen as oxygen atoms in each molecule, the hydrogen and oxygen being present in the same proportion as in water—two of hydrogen to one of oxygen. Starch is the most important carbohydrate found in flour, and constituting about 65 per cent. of its bulk. It is, therefore, of importance, as it is the principal food-stuff in bread. In sound wheat, the starch granules are whole; should the wheat be soaked with water and become heated, or in the event of the wheat being sprouted, these starch granules become pitted, and portion of the starch is converted into sugar and dextrin.

Besides starch, there is always a small amount of sugar and dextrin found in wheat. In sound wheat, the sugar present should be as cane sugar. If present as maltose, this indicates that a partial change has taken place through the hydrolysis of portion of the starch by enzymes into maltose. The presence of dextrin is due to the same cause.

Ash.—The ash is of considerable importance from an agricultural point of view. Whilst the organic portion of the plant may be wholly obtained from the air and from water, the inorganic or mineral portion is obtained exclusively from the soil. In view of the prominence given to the ash constituents in recent discussions on strength, we append the average analyses of the ash constituents of ten typical Victorian wheats:—

Average Ash Analyses of Ten Typical Victorian Wheats.

	Per cent.
Ferric oxide (Fe_2O_3)	0.50
Alumina (Al_2O_3)	0.58
Brown oxide of manganese (Mn_3O_4)	1.62
Lime (CaO)	3.72
Magnesia (MgO)	14.61
Potash (K_2O)	29.93
Soda (Na_2O)	3.24
Chlorine (Cl)	0.90
Sulphuric anhydride (SO_3)	3.02
Phosphoric anhydride (P_2O_5)	40.87
Silica (SiO_2)	1.51
Total	100.50
Less Oxygen = Chlorine	0.50

Commercial Testing of Flour.

In judging the commercial value of a flour, the miller and baker are guided largely by the colour, strength, gluten content, and flavour of the flour.

Colour.—The colour of the flour is very important to the miller, and his constant aim is to produce a flour which will yield, on baking, a loaf of snow-white colour. The consuming public have got into the habit, whether rightly or wrongly we need not consider here, of judging the quality of bread by its colour. Dark-coloured bread, such as would be made, *e.g.*, from certain durum wheats, would be looked

long years to white bread. It does not follow that the snow-white bread is more nutritious than the dark-coloured bread made from the flour of certain varieties of wheat. Indeed, experiments have demonstrated that certain of these varieties produce bread of greater dietetic value than bread from the white wheats.

The point is that the public demand snow-white bread, and the miller seeks to meet that demand. Hence the reason for the "bleaching" of many of the darker flours with nitrogen peroxide, so commonly practised in America during recent years.* Such bleaching, however, is quite unnecessary with the greater number of Australian varieties, for these have obtained world-wide renown on account of the excellent colour of the flour. One of the reasons why Australian wheat is so prized on the English market is that it yields, on milling, a flour of excellent colour, and is therefore of the greatest value for blending with the darker, but more glutenous and stronger, foreign wheats.

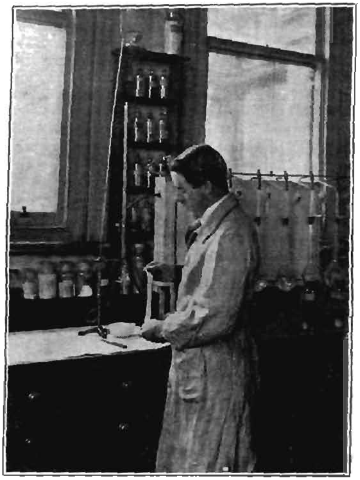


Fig. 5.—Estimating the Water Absorption Capacity of the Flour.

The test generally employed for judging the colour of the flour is the well-known Pekar's test. A simple method of carrying out this test is to take a small glass slide 3 inches x 1 inch, ground on one side, and, with a spatula, firmly compressing a small quantity of flour on the rough side of the glass, and immersing the whole for a few seconds in water. On allowing the mass to dry, the surface of the flour forms a firm continuous skin, and changes to a colour characteristic of the variety. The majority of Victorian-grown wheats have a creamy colour. Wheat from Gippsland gives a dull, dead white colour. Durum wheats yield a flour of deep yellow tint, whilst a few varieties of this species—Medeah, Huguenot, &c., show patches of dull brown. Flour of a grey or light yellow colour usually gives a good white loaf.

Strength.—A strong flour from a baker's point of view is one that is capable of absorbing a large quantity of water and of yielding a large quantity of bread of good shape and texture per sack of flour.

Jago* defines strength as the capacity of the flour for producing a bold large volumed, well-risen loaf. The Home-grown Wheat Committee† defines a strong wheat as one which yields flour capable of making large well piled loaves. It is evident, therefore, that a baking test is necessary in order to obtain the requisite information.

The question of what constitutes the strength of flour from a chemical stand-point has given rise to a number of investigations of more or less practical significance. A brief *résumé* of some of them will now be outlined. Ever since the researches of Messrs. Voorhees and Osborne into the composition of the proteins of wheat up to recent times the opinion was generally held that the gluten content was a prominent factor in determining the strength of the flour. This may be partly accounted for by the fact that a high gluten content was generally associated with a strong flour, and that gluten possessed a certain amount of tenacity which enabled it to hold and enclose the carbon dioxide gas generated during the baking process through the agency of the yeast. Exception was taken to this opinion, it being found that it does not always follow that high gluten wheats give such large well-piled loaves as some other wheats containing a lower percentage of gluten. The failure on this point led to a series of investigations into the difference of the quality of the gluten from a physical and chemical point of view.

The water-absorbing power of the gluten was then examined by comparing the difference in weight between the wet and dry gluten. The expansion of the gluten was also determined by means of an instrument designed for the purpose—the aleurometer—the gluten being heated up to the temperature of the baking oven, and the expansion measured by a scale. Both these tests have been accredited with affording some indication of the strength with indifferent results. Glnten, as has been stated previously, is mainly made up of two separate proteins—glaidin and glutenin. That there might be some quality due to the ratio of the one to the other of these two proteins has occasioned a good deal of work of an investigational character. Guthrie (Australia), Fleurent (France), and Snyder and Guess (America) have been prominent workers on this question.

The results of these investigations were of a variable nature, but they demonstrated conclusively that neither the absolute percentage of glaidin nor the ratio of the glaidin to the glutenin, or to the total protein, were satisfactory indicators of the strength of a flour.

Professor T. B. Wood, of Cambridge, says that strength is a composite of two factors; one which is responsible for the size or volume of the loaf, whilst the other is responsible for the shape. As the result of a series of laboratory investigations he is of the opinion "that the size of the loaf depends on the presence in flour of a ferment which is able to change the starch of the flour into sugar when provided with moisture and warmth as it is in the dough during the proving stage."

The sugar so produced provides food for the yeast, thus producing a stronger growth and evolution of carbon dioxide gas. On the other hand, the shape and texture of the loaf depends on the quality of the

* Jago.—*Technology of Breadmaking.*

† Home Grown Wheat Committee of the National Association of British and Irish Millers.

gluten. This in turn depends on the soluble salts contained in the flour. Wood concludes from a comparison of the soluble salts in high and low strength wheats that high strength wheats contain (*a*) a higher percentage of soluble phosphates, (*b*) a higher ratio of magnesia to lime, (*c*) a lower percentage of chlorides and sulphates, than low strength wheats.

It will be seen from the foregoing brief *résumé* that the problem as to what factors constitute strength in flour is very intricate, and at the present time there is certainly no unanimity of opinion as to the cause of strength, and as to how the strength may best be estimated. For many years past, however, it has been the custom in agricultural laboratories to use the water absorption capacity of the flour as a

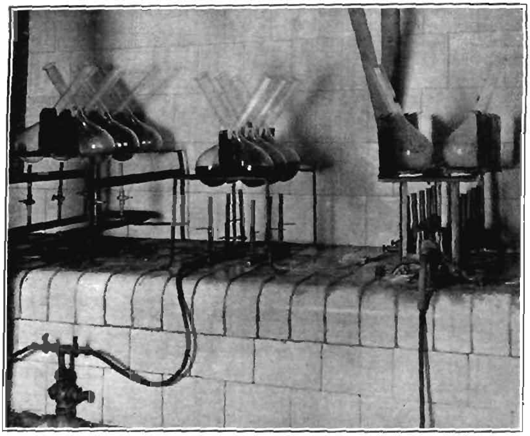


Fig. 6.—Kjeldahl Digestion Apparatus for Nitrogen Determination.

measure of the strength. When such determinations are supplemented with baking tests, accurate and reliable information can be gained as to the strength of different varieties of flour.

The water absorption capacity is determined by running from an ordinary burette sufficient water to make with 40 grams of flour a dough of a consistency fit for baking. This consistency is, of course, a matter of judgment, but, when baking tests are correlated with determination of the water-absorbing capacity, the operator can soon accurately determine the consistency most suitable for baking. The measure of strength, or water-absorption capacity, is usually indicated in quarts of water absorbed per sack of flour. Thus a flour with a strength of 48 would require 48 quarts of water to be added to a sack of flour

is one which is very simple, and can very readily be performed by any miller or baker.

Wheaten flour differs from all other cereals in that, after it has been made into a dough with a little water, it is possible to wash away the starchy portion, and leave a sticky adhesive residue, consisting mainly of proteins called gluten. Gluten is generally considered as one of the most important constituents of flour. The physical properties of a flour may be said to depend on the quantity and quality of this material, since it is owing to the gluten that the baker is enabled to make a dough fit for baking. The carbonic acid gas produced by fermentation in the dough becomes entangled in the gluten, and gradually distends it during the rising of the dough and the baking of the bread. For a flour to be of good baking quality it is obvious that there must be a sufficient *quantity* of gluten present in the flour to retain the gas produced during fermentation, and the *quality* of the gluten must be such as to confer elasticity on the dough. Whilst the gluten must be highly elastic, and readily yield to distention without disruption, it must also be sufficiently rigid to maintain a good shape during the process of baking.

Gluten varies greatly in quality and colour. Some glutens are hard and brittle, others tough and elastic, others too elastic and with little or no gas-holding power. The colour varies from grey to brown.

(*To be continued.*)

CUT WORMS.

The Agrotis and other allied caterpillars, only too well known as cut-worms, have proved by far the worst scourge which Victorian vineyard reconstitution has had to contend against. Where active steps have not been taken to combat them, complete failure of an otherwise faultless plantation has several times occurred. In the case of planters lacking previous experience of the pest, irreparable damage has sometimes been done before the cause of the trouble was even suspected.

Growers are now on their guard, and by the methods detailed in the *Journal* for July, 1911, more especially by the use of arsenical baits, have been able to protect themselves completely, even in so bad a season as the last one, when cut-worms were unusually abundant. This has been at the cost of much vigilance and the repeated spreading of baits, necessitating the expenditure of much time and money.

In *Le Progres Agricole* of 20th July last, a novel plan of campaign against the pest is described by a Southern French vineyard proprietor, Baron Duplessis de Pouzilhac. Being strongly recommended by Professor Degrully, of Montpellier, it can confidently be brought under the notice of Victorian vine-growers.

The new method comprises two distinct phases—1st, the decoying of the caterpillars by means of vegetable baits; 2nd, their ultimate destruction with a corrosive liquid.

The bait recommended is a small patch of peas, eight seeds are enough for a patch, which should be sown near the vine, and early enough to be up before the latter starts to grow. Cut-worms, it seems, eat peas greedily; so long as these last, the vine is safe. The growing of peas, to decoy the pest away from the vine has been previously recommended in France. It is the second phase, the destruction of the caterpillars, which is new. The patch of peas serves to gather the caterpillars into a limited area, where their presence can be ascertained, and where they can be easily destroyed.

Various liquids were tried for the latter purpose, many of which failed to wet the skin of the insect. A 3 per cent. solution of commercial cresyline or creoline* was finally adopted. This proved entirely satisfactory, being very deadly to the insects, which are readily wetted by it. About a pint of solution to a patch of peas is enough to wet the soil sufficiently and to destroy all the caterpillars, which are to be found about an inch or so below the surface. It can be most conveniently applied with a spray pump with a worn nozzle, such as will produce a shower rather than a true spray.

Baron Duplessis graphically describes the effect on the pest, which is immediately evident. In less than two minutes the caterpillars come out of the wetted soil, twisting and wriggling in great agony, and dying almost immediately. Some die half buried, after frantic struggles, with only their heads out of the ground.

The peas are also killed, but there is no further use for them since the cut-worms are completely destroyed.

Lest the creoline solution might damage the young vine, the peas should be planted a couple of feet away from it. Baron Duplessis' experience, which was entirely satisfactory, was amongst full-grown vines, which, in France, are often attacked by the pest.

The cost of treatment is put down at 2s. 8d. per acre for peas—seed and labour—and 8s. per acre for destroying the grubs—solution and labour—the latter expenditure being only necessary if cut-worms appear. This is based on 1,760 vines per acre. With our wider planting, the cost would be less for seed and creoline, at least.

THE SOY BEAN—

A few years ago this bean, and the cake made from it in crushing for oil, obtained a sudden popularity among cattle-feeders in Grea Britain. It was cheap, and appeared to be good. Contrary to ex pectation this popularity has not been maintained, and, according t *Fertilisers*, indications are present that the farmer is now somewha averse to using it. Shipments fell from 492,000 tons in 1910 to 326,00 in 1911, and 288,000 tons in 1912. The Continent took a large pro portion of recent shipments, and leading Hull crushers state that th British farmer has not taken to the soy cake as it was expected h would do.

CITRUS CULTURE IN VICTORIA.

(*Continued from page* 507.)

PART VI.—IRRIGATION, CULTIVATION, AND DRAINAGE.

By S. A Cock, Orchard Supervisor, Bendigo and Northern District.

Citrus fruits cannot be successfully raised without proper and intelligent irrigation. No fixed number of waterings, or definite quantities to be applied can be laid down. Summer rains will vary the quantity and number. The practice of pouring water into the soil irrespective of the requirements of the plant is a dangerous one, especially with citrus trees. Waterlogged areas are most injurious under any system of irrigation, and irrigation should be so practised that a minimum amount of water is lost, and the actual requirements of the plant estimated. Try and place the water where it is required. Careful grading and proper levelling is necessary. Perfection cannot be attained; but it can be aimed at. Soils, situations, and climatic influences have all to be considered, and intelligent deduction made. Rainfall and evaporation should also be studied.

Generally speaking, the suitable citrus areas are situated in the northern portion of the State, where the rainy months extend from April to September, during which time two-thirds to three-quarters of the rain probably falls, the remainder falling as showers or heavy thunderstorms in the spring and summer. Periods of two to three months often occur when no appreciable rain falls. The summer climatic conditions are, therefore, dry and sunny, and evaporation great, hence, irrigation becomes a necessity to produce summer crops of any description:—

Rainfall Table for Citrus Area.

District.	Number of Years for Average.	Number of Inches per Year.	Number of Rainy Days per Year.	Height above Sea-level.
				feet.
Mildura ..	20	10·94	54	153
Swan Hill ..	27	12·30	56	227
Kerang ..	34	13·86	51	255
Echuca ..	32	16·90	76	315
Shepparton ..	13	19·58	83	372
Wangaratta ..	29	24·81	77	493
Rochester ..	23	16·61	58	378
Bendigo ..	49	21·50	101	758
Horsham ..	37	17·62	100	434

The capacity of the soil for absorbing and retaining water as well as drainage has to be understood. Coarse-grained, open, sandy soils take water freely, and evaporate it quickly. Fine-grained, close-textured, clay soils absorb water slowly, and evaporate it slowly. Retentive clays underlying sandy soils become waterlogged under irrigation, unless artificially drained. Coarse gravels immediately underlying sandy soils drain too quickly and dry out. Sandy soils

overlying porous subsoil take water, as at Plate 34, Fig. III. by lateral spread, less readily than by downward percolation, and require fast watering. Fairly retentive subsoils underlying sandy soils take water as indicated (Plate 34, Fig. IV.) more readily by lateral spread than by downward percolation, and require slow watering. Furrows for watering should be ploughed as deep as possible. Flooded

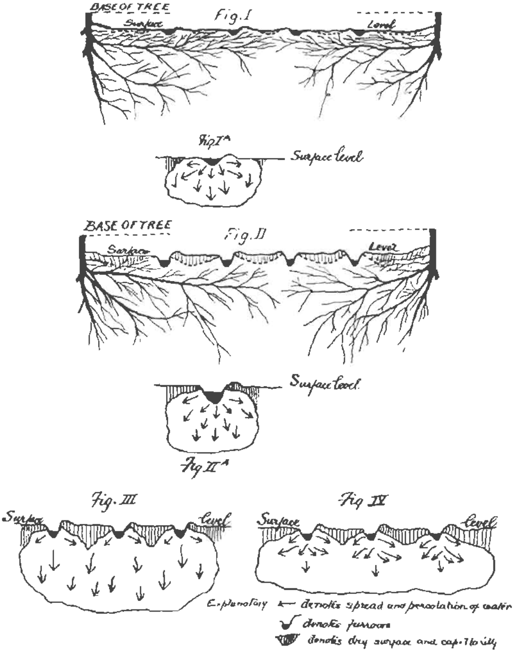


Plate 34.—Irrigation. Scale: 8 feet to 1 inch.

surfaces prevent the escape of air from the soil, and water cann enter the soil properly until the air escapes. Watering by wi shallow furrows spreads the water on the surface, and wets the surfa soil by lateral spread, as indicated in Plate 34, Fig. 1A; the wett surface rapidly hardens after irrigation, and requires immediate cul vation to prevent evaporation. It also has the tendency to indu as shown (Plate 34, Fig. I.), and exposes to inju

from cultivation implements the roots thus induced to the surface in search of moisture. Water applied in this manner has not the same downward percolation, and is not so beneficial as when applied in deep furrows. Furrows should be thrown out at least 8 inches deep, the water is then kept in the bottom of the furrow, and the spread is lateral and downward under the surface, as shown at Plate 34, Fig. IIa. After irrigation, cultivation is, of course, necessary, but very often, especially as regards young trees, all that is required to hold the moisture is to plough the out-turned sod back into the wet furrow, thus retaining the moisture by a soil mulch. No other cultivation is necessary, except light hoeing the wetted surfaces surrounding the tree to break capillary ducts. This deep furrow irrigation ensures deep rooting, as shown at Plate 34, Fig. II., and no danger or risk of injury to roots by cultivation.

Where applied to trees over three years old by running in three or four furrows, the whole surface should be cultivated after irrigation. The deep furrow system allows of the free escape of air from the soil. The estimated air space in cultivated soils is from 25 per cent. to 50 per cent. of their volume, and this space, if filled with water, is the maximum capacity, or saturation point. This state is not required; plants thrive best when half the pore space is filled with air, or the capillary water present amounts to not more than 50 per cent. of its water-holding capacity. Roots require the presence of oxygen for the performance of their vegetative functions, and, in a large measure, the productiveness of highly-cultivated soils is due to the ready access of air to the roots. Citrus trees have shallow feeding, as well as deep feeding, roots, and the natural shape of the tree indicates that the branches spread over the shallow feeding roots to prevent evaporation. In its primal state it conformed to environment, probably droughty conditions. In most of our soils the natural rainfall will carry on the tree for a time; the tree will survive, but not succeed, and, in order to ensure success, water requirements must be considered.

An orange grove twelve years old, and planted 20 feet apart, is calculated to evaporate 9-acre inches of water in one year. (United States Department of Agriculture, 1889.) On the granitic, sandy soils of Harcourt, apples and pears are produced successfully on an annual average irrigation of about 6-acre inches, supplied at three or four periods during the summer. Without irrigation, successful crops could not be produced. On the silurian soils of the Bendigo district irrigation for deciduous trees is not generally practised, only in exceptionally dry seasons. Oranges and lemons, however, require from 3 to 6-acre inches of irrigation water per year, applied at three or four times during the summer. At Echuca and Rochester, deciduous fruits can be successfully raised on about 4 to 6-acre inches of irrigation water per year, applied in three periods, October, December, and early February. Twelve to twenty-year-old citrus trees require from 6 to 12-acre inches of irrigation water per year—about 6 inches on the Murray sedimentary soils, and up to 12 inches on the sandy, pine-ridge country. This total quantity is applied at three or four periods, October, December, and February, and a later watering if the autumn be dry, giving from 2 to 3-acre inches each watering. The late autumn irrigation should only be given when the trees absolutely

require it, as the tendency is to reduce the temperature of the soil too much to allow of vegetative activity. In exceptionally dry seasons allowance has to be made, and rainfall deficiency averaged, also allowance made for increased evaporation.

At Swan Hill, Nyah, and Mildura, evaporation is greater, and rainfall less, consequently more water is required. Autumn ploughing and early September ploughing will conserve the winter rains, and Mr. C. McDonald, "*Riversdale,*" Koondrook, a most careful irrigator, states, "I fully believe, by late autumn and early spring ploughing, and frequent summer cultivation, I can so conserve the winter rains that I will be able to successfully produce citrus fruits on half the water I am at present using."

Head ditches and main distributory channels should not be placed too far apart. In leading water down a furrow, it stands to reason that the ground nearest the supply channel receives the most water; therefore, it is advantageous to try and equalize the distribution. No furrow should be over five chains in length, and, if it is possible, they should be less. The practice of making deep delver drains can also be improved on. In grading deep soils, enough soil can be spared and gathered to form a good strong ditch, or other channels on the surface.

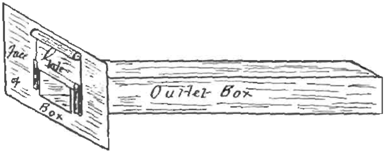


Plate 35.—Outlet Box.

Care must be exercised in making the banks to see that they are strong enough to carry the water in the channel. A lot of seepage takes place from delver drains. A channel prepared as suggested prevents a deal of seepage, as the soil is not broken. Outlet boxes are also easily placed in such constructed channel banks, and take the water from the bottom of the ditch. Breaking the channel banks for every irrigating is not economical; outlet boxes, with regulating gates should be provided for every row or two rows of trees. A convenient size for one row of trees of two furrows will be found 2 inches square; boxes as described can be made of galvanized iron or wood, and should be 3 feet long in the box, with a broad face and gate. See Plate 35. The gate portion is placed in the channel, and can be locked down to any quantity of water desired. The broad face prevents seepage in the bank where the box is placed. The cost of these boxes is not very great, and the convenience in use compensates for the outlay.

The system of watering varies. The most economical system for one and two-year-old trees is shown at Plate 36, Fig. I. Furrows are led down each side of the tree 2½ feet away, and spurs led into the tree as at A and B, in Plate 36, Fig. II. Furrows are led down, and also ploughed across, and joined up as at C and D. Cross furrows are indicated by dotted lines, and, where joined with distributing furrows,

once a month will be found sufficient. At two and three years, the furrows are placed a little further away from the tree, 3 to 3½ feet, and joined up with the cross furrows, as at C and D, Plate 36. Fig. III. At two and three years, four or five waterings will probably be found sufficient. At four, five, and six years, the furrows are placed a little further away, and an additional furrow led down the centre, and across, and joined up as at C and D, Plate 36, Fig. IV. At this age trees may require water every five or six weeks. From seven years and upwards, four furrows should be led down between each row and across, the nearest furrow to the tree being 4½ to 5 feet away from the butt, and equidistant between each furrow 4 feet, and joined up as at C and D, Plate 36, Fig. V. Allowing the lateral underspread of water

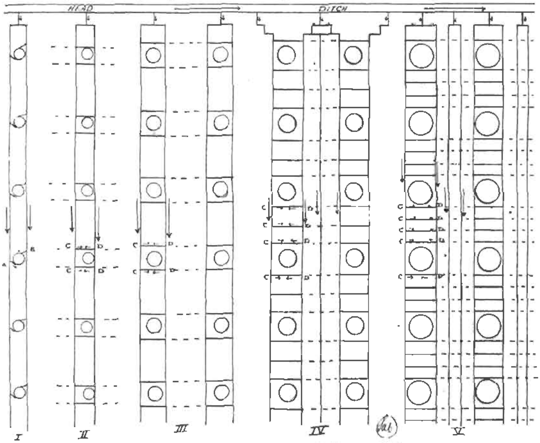


Plate 36.—Method of Watering. Flow of Water indicated by Arrow.
Scale: 40 feet to 1 inch.

in average citrus soil at 2 feet, there should be perfect wetting of the under-soil and equal watering, the distance of the furrows from the trees, 4½ to 5 feet, being compensated for by mulching, and less evaporation, owing to pendant foliage. Trees from seven years upwards require watering three or four times in the year, or about every six or eight weeks. Plate 34, Fig. I., shows a cross-section of four furrows, and equal shallow furrow watering. Plate 34, Fig. II., shows equal deep furrow watering and advantage gained by deep underspread of water, and consequent deeper rooting.

Cultivation is directly beneficial in retaining the water in the soil, and holding it at proper heights, so that the plant will receive the maximum benefit from the minimum application of water. Sandy soils dry out quickly by reason of the fact that downward percolation and

capillary ascent is quickest. Wetted surfaces assist in evaporation. Dry mulches prevent evaporation, consequently cultivation is practised to prevent this and retain the moisture in the soil. By cultivation, capillary tubes are broken, hence after irrigation it is necessary to cultivate. Rain causes the soil particles to run together, and consequently increases their capillarity, hence these must be broken up. Cultivation reduces the quantity of water to be applied. Soil aeration is necessary to nitrification. In sour soils nitrification is interfered with, hence cultivation and good drainage are essential. Cultivation is not required in the winter, so a calendar of work may be laid down. Plough in the autumn after the first rains, leaving a furrow in the centre of the land, ploughing to the trees. In early September plough from the trees, filling in the furrow in the centre of the land. Harrow and cross-harrow. Cultivate, after every irrigation or rain, from October to March. Plough at varying depths to prevent hardpan, caused by plowsole. Cultivate with the disc or spring-tooth harrow in the summer. Under-drainage is a great advantage; residual water is thereby removed, and stagnation prevented. The apple orchards of Harcourt are nearly all tile drained. In 1900 the citrus trees of Mildura were in a serious condition; over-irrigation and channel seepage had brought about waterlogged conditions with their attendant evil consequences.

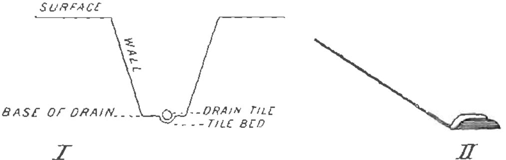


Plate 37.—Fig. 1. Drain. Fig. 2. Ditching Plough.

At the suggestion of the writer, tile drains were introduced, and the drains carried into wells sunk into the drift. This system is now being more generally adopted. At Cohuna it will have to be faced in regard to alkali soils, and also in many of our new settlements for channel seepage. If no drift is to be found to drain into, then the water in the wells can be thrown out by windmills. The water should be kept moving. Tile drains are best placed 2½ to 3 feet deep in the ground. Drains should be laid at least in every second land, and 3-inch tile drains used, joining into a main 4-inch drain, which leads into a well or any natural depression. Drainage is necessary on irrigated areas; it is an essential in citrus culture, and is of direct benefit wherever practised. The consensus of opinion of growers who have tile-drained orchards is that under-drainage minimizes the quantity of water to be applied, and increases the productiveness of the orchard. Three-inch drain tiles cost £4 5s. per 1,000 landed at Harcourt. The cost of cutting drains 2½ feet deep, laying the tiles, and filling in is about 5s. per chain, or a total cost of about 10s. 6d. per chain. In the Harcourt district the drains are cut with a ditching plough, and the bed cut out with a ditching shovel, as shown in Plate 37, Fig. II. This cuts out a hollow big enough to receive the tile, and prevents side roll. Plate 37, Fig. I., shows cross-section of a drain, with tile fitting in tile-bed. Only round

tiles should be used, and they should be joined up as close as possible and properly bedded. In returning the soil, care should be taken not to displace the tiles. Return the clay first, tightly pack, and then the soil. In mapping out the orchard for the drains, the fall should be reckoned. The main drain is carried up the lowest part, and the lateral drains are brought to it in parallels down the inclines. Where the surface is not undulating, the drains are usually cut in parallel lines down the declination of the ground, not that all the drains of the same orchard shall be parallel, but only those in the same plane, whatever number of planes may exist. In an orchard of one plane there can be no difficulty in setting off the small drains, as they should be parallel to one another, and all terminate in the same main drain, whether the orchard is nearly level or has a descent. Drains should be carried

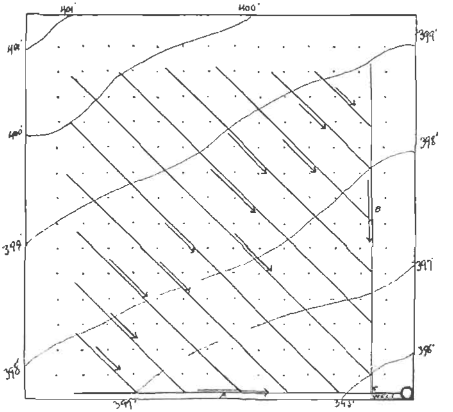


Plate 38.—Drainage of an Orchard. 401-396 Contour Lines.
Scale: 110 feet to 1 inch.

through each plane of the orchard irrespective of the wet or dry appearances of the soil, because the complete removal of all stagnant water is the object aimed at by draining. Portions of the land which may appear dry at one time may be in a wet state at another, and may seem always dry on the surface when in fact the subsoil may be in a state of injurious wetness. Drains cut across the decline have not the same effect upon tenacious and impervious strata as drains cut up and down the slopes.

Plate 38 shows the drainage of an orchard drained in every second land. A is the main drain, B a secondary main drain junctioning with A at C and draining into a well or some depression, and typical of our irrigation areas.

(To be continued.)

BEE-KEEPING IN VICTORIA.

(*Continued from page 493.*)

By F. R. Beuhne, Bee Expert.

XIV.—DISEASES OF BEES—*continued.*

DISAPPEARING TROUBLE.

Of the cause of the periodical mortality known by the name of Disappearing Trouble or Spring Dwindling nothing definite is as yet known. It appears to be a result of certain climatic conditions in the autumn preceding a winter or early spring honey-flow from certain eucalypts, and is looked upon rather as a condition of the bees than a disease. A characteristic of this trouble is that there are no symptoms. Colonies become gradually, and sometimes rapidly, weaker day by day without more than the normal number of dead bees being visible in or near the hives, while under microscopical examination neither dead nor live bees from the dwindling colonies differ in any way from bees of normal colonies in districts unaffected. If the dwindling takes place during midwinter the queen and the last hundred or so of bees perish from cold; when it occurs in spring, the bees and queen swarm out and join some other colony when a point of numbers is reached from which the colony could no longer recover. The queens of colonies which dwindled in this way, when introduced to normal colonies in an unaffected locality, do not reproduce dwindling in succeeding seasons, and the combs from which the bees disappeared in no way affected other bees which were put on them.

During the spring of 1909, and again in 1912, heavy losses of bees were experienced in the country near the Grampians, but not in the scrub country on and inside the ranges. In both 1909 and 1912 there was a dearth of pollen in the preceding autumn, followed by a honey-flow from ironbark eucalypts, *E. leucoxylon* and *E. sideroxylon*. The former is known by different names in different localities, such as white ironbark, bluegum, whitegum, and spotted box. The latter is everywhere called red ironbark. Both are winter bloomers, and secrete nectar very freely, but produce no pollen for bees.

It has been suggested that the abnormal activity of the bees during a period when they should be semi-dormant, which is caused by the flowering of ironbarks, causes the premature wearing out of the workers, and there seems to be some force in this contention. The opposition to it is, however, the fact that when the tree variously known as cabbage gum, bastard box, peppermint, &c., flowers during the winter months, bees work freely on it and come through strong. This tree, however, produces pollen freely, and, while but little brood can be reared owing to low temperatures, the nitrogen withdrawn from the body of the bee by the secretion of the enzyme which is necessary for the changing of the nectar into honey, is continuously replaced by the consumption of pollen found on the blossom from which the nectar is gathered, and thus the vigour and vitality of the bee are maintained when gathering from pollen-producing blossoms, but impaired when [illegible] flowers producing nectar only.

Dr. Kramer, a well-known Swiss authority, states that sugar syrup (which contains no nitrogen) fed to bees and extracted contained the same amount of nitrogen as pure honey. The nitrogen was added out of the bee's own organism. "That," Dr. Kramer says, "explains why after being fed sugar, bees are so eager for pollen, also why bees rapidly become enfeebled upon being fed sugar when no pollen or substitute is available" (*Gleanings in Bee-culture*, Dec. 15, 1912, page 817).

As bees do not obtain pollen from ironbark blossoms, a winter flow from that source is the equivalent to heavy sugar feeding with a lack of pollen at the same time, which, as Dr. Kramer further on in the same article says, "so rapidly decimates the colonies."

Pending the collection of further data on this subject, and the discovery of a means of supplying nitrogen artificially, beekeepers in localities liable to this trouble will be well advised to remove their colonies to some other locality during the "off year" preceding the blooming of the ironbark.

XV.—SPRING MANAGEMENT OF BEES.

During the first or second week of September, all hives should be examined for the purpose of seeing whether each one has sufficient food, a laying queen, and enough bees to enable it to work up into a profitable colony.

This examination should be made only on fine mild days, otherwise harm will be done to weak stocks, by letting the warmth escape when opening the hive and by causing the bees to fly and become chilled. Having lighted the smoker, blow one or two whiffs of smoke in at the entrance, lift the cover at one end, and blow a few puffs of smoke over the top of the frames. When quilts are used between covers and frames, hives can be opened with less disturbance, less smoke is needed, and it is consequently easier to find the queens.

The amount of stores is the first consideration of this time of year, but no hard and fast rule can be laid down as to the actual weight of honey required to maintain and develop the colony. The quantity depends upon the number of bees in the hive, the length of time which may elapse before they can find sufficient new nectar in the blossoms of the immediately surrounding country, and the weather conditions prevailing during the following four or five weeks. In no case, however, even under the most favorable circumstances, should there be less than 5 lbs. of honey (equal to one well filled Langstruth comb) in the hive. Bees build up in spring on their winter stores, excepting in specially favoured localities with a mild climate and an early flowering flora. From 15 lbs. to 25 lbs. of honey is more like the quantity required in an average locality to obtain the best results in brood-rearing till sufficient new nectar is available from outside sources. As the consumption greatly increases as soon as brood-rearing commences, any shortage should be made good by feeding sugar syrup.

If no feeders are on hand, a clean empty comb may be filled with syrup by placing it flat in a milk or other suitable dish and pouring the syrup into the cells from a height of about 15 inches. When one side is filled, the comb is turned over and the other side filled. To get a fine stream of syrup, a jug with a rather pointed lip is the most suitable vessel. When the comb is filled, it should be held or suspended over the

dish for a short time, to allow the surplus syrup to run off. The latter would otherwise fall on to the floor of the hive, and in all probability attract robbers.

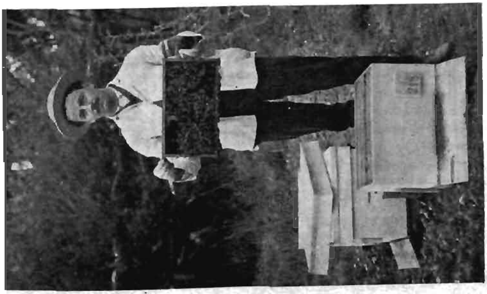
Every hive should have a fertile queen; and, as a minimum, bees on at least two or three combs. It is not absolutely necessary to see the queen, the presence of eggs and of brood in the several stages being sufficient evidence that the queen is all right. When the eggs, however, are at the side of the cell bottom, and not in the centre, laying workers instead of a queen may be present.

A further indication of laying workers, an unfertile young queen, or an exhausted old one, is that the cappings of the sealed brood, instead of being only slightly oval, are hemispherical and project much beyond the general surface of the comb. This is due to the fact that the eggs of laying workers and unfertile or exhausted queens produce drones only. The larvæ of the latter are larger than those of the workers, and being in worker instead of in drone cells there is not sufficient depth and the cell is therefore lengthened in capping it. If a hive in this condition still contains sufficient bees, and is to be retained as a separate stock, the laying workers or the drone-laying queen must be replaced with a fertile queen. With Italian bees, which are quieter than blacks, and the queen differently marked from the workers, she is usually easily found. Black queens are often very hard to find on account of their sombre colour and the habit of black bees of clumping or running off the combs when disturbed.

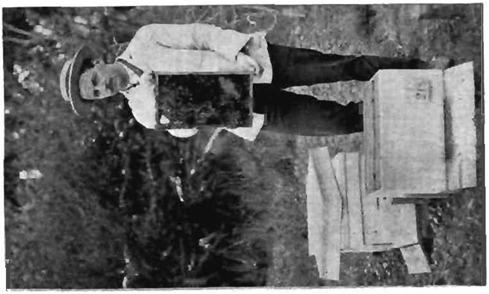
Correct Way of Handling Combs.

In hunting for queens, or examining brood for disease, it is necessary to see both sides of each comb. To do so, many bee-keepers turn the comb in the wrong way, resulting in a fracture of the cells near the top bar when the comb is not built right down to the bottom bar and it is at all heavy with honey. It also causes spilling when the comb contains new thin honey. A comb should never be turned on a horizontal, but always on a vertical axis. Combs fractured or strained through handling them the wrong way often mash up in the extractor. When the combs are returned to the hive the bees repair them; but, as the damaged cells, become elongated through the weight of the comb, they are large enough for drone-brood, several rows of which will be found across the comb where it was fractured when the comb is used in the brood-chamber. Combs so damaged are also very liable to come down in hot weather or in moving bees by road or rail.

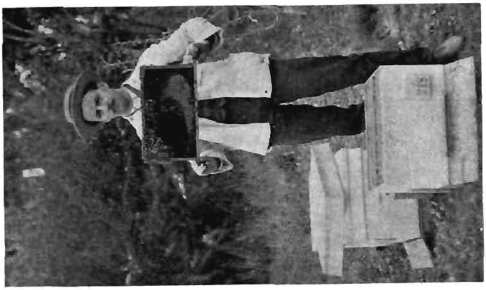
If combs are handled the right way, no harm will be done to them, even when built from starters and not fastened to the bottom bar of the frame. As bees generally, and queens in particular, run to the bottom of the frame when it is lifted out of the hive, it often becomes necessary to turn the frame upside down when looking for the queen. In Fig. 1 is shown the first position; to turn the frame upside down without damaging the comb the top bar of the frame is brought into a vertical position as shown in Fig. 2; and by swinging the frame half-way round (like a door on its hinges), and then bringing the top bar into a horizontal line, the frame is completely reversed as shown in Fig. 3. As the bees again travel downwards, the queen, if she is on the particular



1. First Position.



2. Second Position.



3. Third Position.

CORRECT WAY OF HANDLING COMBS.

comb, will be noticed. To turn the comb to the hive, the same movements are again gone through, but in the reverse order of 3, 2, 1.

If, in the course of the first examination, one or more colonies are found with unfertile queens, the hives should be marked and left alone till the overhaul of all of the colonies is completed. Amongst a number of stocks of bees there are generally, at this period of the season, some which are weak in bees, though possessing a fertile queen. These queens may with advantage be used to replace unfertile ones in colonies with more bees. To transfer a queen, it is first of all necessary to find and remove the one which is to be replaced. The following day, preferably towards evening, the small stock with the fertile queen is placed alongside. Both lots are gently smoked, and the combs with brood and bees from both put into one hive, so that each comb from one is between two from the other hive. The outside combs of both are put into the other hive body which is placed on top of the first, the bees brushed off the combs, and the latter and the hive body removed. If uniting is done later in the season, the second body and combs may be left on as a super.

When no small stock with a laying queen is available, a colony with an unfertile queen may be kept going by giving it a comb of eggs, or young larvæ from a normal colony, once or twice a week, according to the number of bees. At the same time, remove one of the combs of drone larvæ and substitute it for the comb removed from the normal colony, which will usually throw out this useless brood. In this way a colony may even be gradually built up; and, when young queens are available from swarmed stocks, the valueless queen can be replaced.

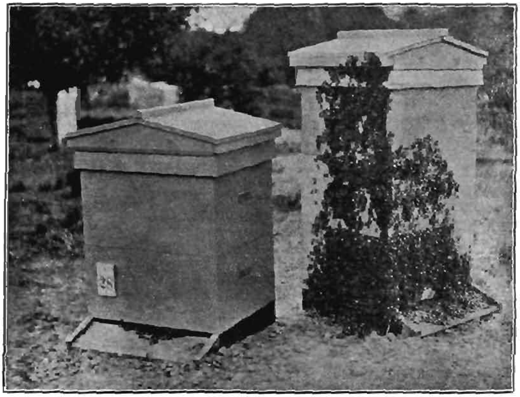
It is often very difficult to get a colony with laying workers to accept a queen, all the bees being old; but, if treated as described, there will soon be a sufficient number of young bees, and the introduction of a queen may then be safely accomplished. Colonies found queenless, and without even laying workers, should be dealt with in the same way, if still sufficiently strong enough to be worth saving.

A mistake, often made by beginners, and even by established bee-keepers, is the spreading of brood with the idea of hurrying brood-rearing. This practice of putting empty combs, or even partly filled ones, between the brood combs, more often results in loss than in gain. It is recommended in some of the text-books written for countries in which the sudden changes of temperature experienced here do not occur. During September and October, colonies have all the brood they can cover on a cold day, and spreading the combs by putting a vacant one in the middle, results in the brood in some of the outside combs perishing from chill. If it appears necessary to give room for brood, the combs should be placed, one at a time, alongside, and not between, the brood.

Under normal conditions, a colony of bees increases rapidly in strength during September and October. As soon as all the combs of the brood chamber are occupied by bees, and before they are actually crowded, the second or upper story should be put on and the bees induced to commence work in it. This is done by taking a comb containing honey from the brood chamber and putting it into the second story and directly over the brood combs, while the frame from the

upper story is placed into the brood chamber. When a colony of bees has become crowded before the super is put on, it will quite likely be inclined to swarm, and no amount of manipulation will cure it of that tendency till the swarming season is over. When bees are worked for extracted honey there is much less swarming than when comb-honey is produced.

If a maximum profit from the number of colonies kept is aimed at, the raising of comb-honey in 1 lb. sections should not be attempted in any locality which has not at least a fair honey flow. Many owners of bees find it very difficult to induce bees to work in the section supers. There are various reasons for this disinclination of the bees to enter sections. Bees at any time prefer to work together in large numbers and without any break in the combs in a vertical direction, and are



SWARM RETURNED AFTER LOSING THE QUEEN.

therefore disinclined to work at comb-building in such comparatively small clusters as the 1 lb. sections necessarily create. Further, the sections are, in many instances, supplied with very small starters of foundation, leaving a distance of 3 inches from the brood-combs to the lowest point of the starter in the section. Bees invariably store their honey just above the brood; and, instead of commencing comb-building on the small starters in the section so far away from the brood and separated from it by empty space and the woodwork of the section, they frequently store the honey they gather into the cells from which young bees emerge. This restricts brood-rearing and causes the crowding of bees in the brood chamber, which is such a fruitful source of excessive swarming.

This difficulty may be overcome by inducing the bees to enter the section, or by compelling them. Bees may be induced to enter the

section super by putting on one or more sections already partly built and containing some honey amongst the empty ones in the super. These partly filled sections are known as bait sections. When none are available, the bees may be compelled by first putting a super of full-sized frames of empty combs; or, failing this, of full sheets of foundation on the brood-chamber. If there is sealed honey along the top bar of the brood combs, the cappings of the honey may be lightly scratched with a fork, which will induce the bees to remove it and the queen to deposit eggs therein, thus bringing the brood right up to the top bar. When this stage has been reached, the bees may be brushed off the combs of the upper story and a section super put in its place. As there is now brood in the combs of the hive right up to the top bar of the frames, and as the bees want to place honey above this brood, they will, as a rule, at once commence work in the section, provided that honey is coming in.

The upper story removed from the hive may be used on another hive for a similar purpose, or as an extracting super. If it contained brood at the time of removal, the largest sheets of it may be put into the brood-chamber. Removing from the latter any combs containing little or no brood, the object being to crowd into the lower story of the section hive as much brood as possible so as to leave no room for honey. Keep the colony strong, and compel the bees to build comb and store honey in the sections. Any brood left over may be given to weaker colonies, but only as much as can be taken care of by each.

As October is the principal swarming month, a watchful eye should be kept on the hives from 10 a.m. to 3 p.m. on fine days, unless the condition of the colonies in regard to the swarming tendency is known, from a record of the ages of the queens and systematic periodical examinations to see whether swarming preparations are in progress.

While it prevents the absconding of prime or first swarms, the clipping of queens often causes trouble through the queens getting lost. The swarm returns to the hive, only to issue again, a week or so later with a virgin queen and a greater number of bees. As a virgin queen is light and has greater powers of flight, such swarms will usually settle high up in inaccessible places or abscond without clustering. It is, therefore, not advisable to clip queens, unless the hives are near a dwelling from which a view of them can be obtained, or the number of colonies is sufficient to keep a special watch on them during swarming hours. The illustration shows a hive to which the swarm has returned after losing the queen.

(To be continued.)

TOMATO CULTURE IN VICTORIA.

(*Continued from page 514.*)

By S. A. Cock, Orchard Supervisor, Bendigo and Northern District.

DISEASES.

The diseases of the tomato can be placed under three headings—(1) Insect, (2) Fungus and Bacterial, (3) Constitutional.

INSECT.

Tomato Moth (*Heliothris Armigera*).—This insect is the most destructive pest of the tomato, and is world-wide in its distribution. French's handbook *Destructive Insects of Victoria*, Part III., page 48, gives a full description, and has a coloured plate, of this pest in all its stages. The eggs are laid by the moth on the leaves and young fruit, and the caterpillar attacks the fruit by boring into the flesh. One caterpillar may destroy many fruits by boring.

Spraying with arsenate of lead will be found satisfactory in dealing with this pest. Spraying should not be carried out on ripening fruit, but if performed when the caterpillars are first noticed, in early December and November, should keep the pest in check.

Cut Worms (various)—*French*, Part III., page 74.—These pests damage the young plants by eating the foliage and stems. They are closely allied to the Tomato Moth. The greyish caterpillars do not move far from the plants on which they feed at night, and are to be found sheltering in the day-time just beneath the surface of the soil, or under litter near the plants. Spraying with arsenate of lead will be found beneficial; they may also be largely reduced by placing traps of half-dead weeds among the plants; the weeds will be found to shelter the caterpillars, which should be collected and destroyed. Arsenic bait is very effective. This is prepared by thoroughly mixing 1 oz. of Paris green or arsenate of lead with 1 lb. of sweetened pollard or bran; this is placed in hollows on the ground among the growing plants. The caterpillars eat the bait readily and die.

Tomato Weevil (*Desiantha nociva*), *French*, Part V., page 41.—This is a small curculio beetle, about ¼-inch in length, of a greyish-brown colour, and causes much damage both in the grub and beetle state. The insects generally feed at night. Spraying with arsenate of lead will be found beneficial if the fruit is not ripening. The better course with this pest is to spread paper or bagging under the plants in the day-time, and in the night-time go among the plants with a shaded lantern. As soon as the light is thrown on to a plant the insects drop to the ground; they can then be gathered and destroyed. Arsenic bait will also be found beneficial.

Metallic Fruit Fly (*Lonchaea splendida*), *French*, Part V., page 21.—This fly does a deal of damage in some seasons. The writer's experience is that it follows the Tomato Moth, and it is not usual for it to attack sound fruit. A favorite point of attack is the bore made by the caterpillar of the Tomato Moth, or any crack or blemish on the

fruit. The maggots soon turn the fruit into a putrifying mass. All infected fruit should be gathered and burned.

Rutherglen Bug (*Nysius vinitor*), *French*, Part I., page 105.—This pest is a tiny light-greyish coloured bug, which appears in great numbers at times, and sucks the juice from the leaves and fruit of the plant. The bugs breed in the open grass lands. When cultivated plants such as tomatoes are attacked, it is no use spraying; smoke fires are found the best, as the smoke will drive the bugs out of the plantation. During the process of smoking the bugs should be stirred up from around the plants with an old broom or beater.

Fungus and Bacteria.

Black Rot (Spot, Black Spot), Rust (*Solani*), Macrosporium (*Alternaria*).—This disease, Black Rot, gains an entrance at the blossom end of the fruit, and causes a depression of the fruit, which at first appears brown, and later on turns to a dark velvety appearance, due to the spores which are formed on the outside of the fruit at this point. The Rust appears on the leaves, and is due to the same fungus. Small brown spots at first form on various parts of the leaves, gradually increase in size until they become large blotches, eventually involving the whole leaf. The terms Spot and Black Spot are also applied to this disease; it is the most serious disease of the tomato. Spraying with Bordeaux mixture or copper soda will be found effective. Spraying should be carried out just after the plants are transferred to the open, and have established themselves. Badly diseased plants should be uprooted and burned.

Irish Blight (*Phytophthora infestans*).—This disease, which did so much damage to the potatoes in 1911, happily did not affect the tomato crop. Its liability to attack the tomato is recognised, however, and attention should always be given to this danger.

Damping Off.—This occurs chiefly among seedlings in the cold frame, and also on plants in the open. The stem decomposes, and just level with the ground the plant topples over, hanging on to its root by the shrivelled skin. Several species of fungi which infest the soil are responsible for this condition; they live on decaying vegetable matter, but also have the power of attacking living tissue. The remedy is care and attention in the selection of soils and manures for the frames and field. Leaf-mould is a common source of infection, and should be thoroughly composted before using. When damping off occurs in the frame, water should be sparingly used, and the surface soil between the plants kept thoroughly stirred and allowed to dry out. Much of the fungi may be killed in this way.

Pimply Rot.—This disease forms black blotches on the half-grown fruit. It is readily distinguishable from Black Rot, as the infected part is usually more or less circular in form, and remains smooth and glossy for a good while after the fruit is attacked. Later on concentric rings show round the central portion, the whole forming a flattened, sunken patch, taking up, sometimes, nearly the whole side of the fruit. This disease commences anywhere on the fruit. Spraying, so far, has not proved of any use against this disease. Infected fruits should be gathered and burned.

CONSTITUTIONAL.

Rosette of the Tomato.—With this disease the large-growing plants are attacked. The new foliage is turned into aborted leaves, forming irregular masses or clusters, and often turning the whole plant into a mass of aborted growth, with well-defined rosettes on the extremities of the leaders and laterals. There is no known remedy for this disorder; infested plants should be eradicated and burned.

Leaf Curl, or Fiery Blight.—With this affection the leaves curl up and expose the under surface to the light, the midrib and veins become distended, and the leaves easily break if bent quickly. The old leaves are generally the first affected; sometimes the whole plant is attacked, and where this occurs the plant fails to bear a normal crop of fruit. The buds either fall or the fruit fails to set. The causes chiefly conducive to this malady are—Excesive amount of water in irrigating; over fertilizing the soil with green stable manure, causing a soft, vigorous growth of stem and leaf; pinching or cutting of laterals and leader growth on too strongly growing plants. None of these may cause damage singly, but if two or three act together, then the grower may look for this disorder among the plants.

In treating diseases, I find that growers are very neglectful of the ordinary methods of clean culture, especially with regard to the destruction of diseased plants and fruit. Diseased fruit and plants should always be destroyed by burning, and not allowed to lie on the ground. Spraying for diseases, both insect and fungus, is to a large extent neglected. I am quite confident that the tomato grower can increase his output per acre to a very considerable extent by more attention to spraying and destruction of diseased fruit, and his motto should be to increase his profits by avoiding his losses.

[With regard to grading tomatoes the following extract from the letter of a New Zealand grower is of interest, he says, "We grade into 3 grades, Choice, No. 1, and No. 2, and that is the reason why our prices kept up. When tomatoes from other growers were only making 1s. 6d. to 2s. a 24-lb. case mine were 3d. to 4d. per lb. for choice, 2½d. for No. 1, and 1½d. to 1d. for No. 2 or sauce grade. It pays to grade and pack well; not only does this apply to tomatoes but also to other fruit."—EDITOR.]

ROOT crops become more digestible as they mature, but fodder crops develop woody fibre on ripening.

IF too much superphosphate is used at seed-time the excess will not be washed away. It will remain in the surface soil, and slowly benefit succeeding crops.

IN order to keep cultivated soils in condition it is necessary to maintain the supply of humus. This can often best be done by ploughing in green manure.

WHEN PLANTS WILT—

When a crop begins to wilt the soil still contains some water. But different soils vary in the readiness with which they give up their water to a growing crop. Thus Sachs found that wilting did not begin on a sandy soil till only 1.5 per cent. of water remained, while it started on a clay soil which still contained 8 per cent. of water, and on a mixture of sand and humus with even 12.3 per cent. It might be concluded from this that sandy soils were better suited than clay and peaty soils to withstand drought, because the former could give more of their water up. The facts, however, are otherwise, because the clay and peaty soils are able to store up much more water to begin with, and as a net result they have more to give away. The stage of soil dryness at which plants begin to wilt is not, however, as is sometimes supposed, dependent merely upon the physical character of the soil, because the relative humidity, or, more precisely, the evaporating power of the air, has a marked effect. The *Plant World* describes experiments showing how atmospheric conditions affect wilting. Plants exposed in the open to the direct rays of the sun wilted sooner than when placed under a lath shelter, those sooner than when placed in a walled house, and those again sooner than when placed in a glass chamber nearly saturated with water vapour. The practical benefit of one season's rainfall is dependent, therefore, not only upon its amount and distribution, but also upon the evaporating power of the atmosphere particularly during the period of active growth. In order to measure this and so co-relate it with the annual rainfall and crop yields, three evaporation gauges have been installed on the Government farms at Werribee, Wyuna, and Rutherglen, in addition to the ordinary meteorological instruments of a first class station.

STANDARD TEST COWS.

FIRST REPORT ON GOVERNMENT HERD TESTING AND CERTIFICATION OF STANDARD COWS.

For Period Ending 30th June, 1913.

By W. A. N. Robertson, B.V.Sc., Chief Veterinary Officer.

In submitting this, the First Report of the Herd Testing Scheme, as carried out by this Department, it is opportune to briefly trace the steps which led to its successful launching.

In nearly all countries in which the dairying industry has been highly developed, associations of one form or another are in existence for the testing of the individual cow. Some of these associations confine themselves to tests covering a short period only. It is, however, becoming more and more evident that, in order to obtain reliable data, the recording of weight of milk must be done daily, and the test must cover a full milking period, and continue from one season to another; for it is well known that great variations may occur in the returns at different stages of lactation and during different calving periods. All progressive dairy farmers are familiar with the conformation which for generations has been regarded as an indication of milking qualities; and most are also familiar with the fact that reliance cannot regularly be placed on type and form as indicative of milking capacity, and oftentimes buyers may be landed with a duffer; but just as the external form is handed down from one generation to another, so also is the capacity for milk production, which, on external appearance, cannot be truly predicted. It is, therefore, only by means of testing over a period, and under careful observation, that the capacity for transmitting milking qualities can be determined.

The scheme for the Government certification of standard cows, which was inaugurated last year, is confined to the testing of pedigreed herds of the various dairy breeds under the strictest conditions practicable, as set out in the regulations hereto. The object designed to be attained is that purchasers of bulls of any dairy breed may be assured concerning the milk and butter yielding capacity of the dams. Oftentimes in the past great disappointment has been experienced by purchasers of bulls from pedigreed herds by reason of their failure to improve the milking capacity of the progeny of cows upon which they have been used. Greater reliance has been placed upon show yard points and so-called milking type than upon actual milking records, and, indeed, the practice of recording milk yields of pedigreed herds has not been at all common in this State, so that the owners were not in a position to give any records to purchasers. It is anticipated that when the scheme comes into full operation dairymen will pay much greater attention to the milking record of the dams in the pedigree than their show yard honours.

For the period which this report covers, terminating on 30th June, 1913, fifteen herds have been entered. The breeder who was first to recognise in a practical manner the benefits to be derived from the test, and to whom must go the honour of being the first to enter his herd, is Mr. F. J. Stansmore, of Pomborneit, who entered, on 14th May, 1912, his Ayrshire herd. He was shortly followed by Messrs. P. E. Keam and C. G. Lyon.

There were many other breeders who, though realizing the benefits to accrue from holding official records for their cattle, were, for various reasons, unable to immediately participate by entering their herds. As the test covers a period of nine months, only those cows which were entered prior to October last can be considered, consequently only a small number have had an opportunity of qualifying for the certificate.

The first samples were taken on the 3rd July, 1913, from the herd of Mr. C. Gordon Lyon; and the herds of Messrs. Stansmore, Keam, and Read were tested soon after, in the order mentioned. Up to the present the butter fat yield (completed or incomplete) of 180 cows is in the possession of the Department, though this number comprises only eight herds of the fifteen entered. The remaining seven herds commenced the test at a later period. The approximate number of cows which will be tested in the fifteen herds is 400. Representatives of most breeds have been entered, viz., Jersey, Ayrshire, Red Poll, Shorthorn, and Dexter Kerry, and the figures already on record indicate that no one breed has quite a monopoly as first-class butter producers. Up to date sixty-two cows have completed their term, and of these all but seventeen qualified for the certificate.

The details of the individual herds are shown hereunder:—

STANSMORE, F. J., Pomborneit (AYRSHIRE).

Cows Entered, 64; Term Completed, 31; Certificated, 18.

Name of Standard Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test	Weight of Milk Last Day of Test	Weight of Milk.	Average Test.	Butter Fat.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.
Rose of Yalart ..	1659	22.5.12	25.6.12*	267	8	7,573	4·12	311½	355½
†Leonora of Yalart ..	2719	28.5.12	25.6.12*	237	1¼	5,064	3·79	192	216¾
Berylan	2714	4.6.12	25.6.12*	236	1	5,174	4·78	247½	282¼
Dimple of Caulfield ..	2715	8.6.12	25.6.12*	242	4	4,524	5·69	257½	293½
Nice of Caulfield ..	2722	11.6.12	25.6.12*	242	2	4,886	4·69	229¼	261¼
Princess Edith of Oakvale	2725	18.6.12	25.6.12*	273	4	5,922	3·8	225	256½
Julia of Yalart ..	2718	1.7.12	15.7.12*	223	1	4,417	4·74	209½	238¾
Ida of Yalart ..	2717	1.7.12	8.7.12	273	8	5,968	4·88	291¾	332½
Rose of Lake View ..	2727	4.7.12	15.7.12*	254	10¾	7,266	4·14	301¼	343¾
Red Lass of Caulfield ..	2726	13.7.12	20.7.12	259	9½	6,215	4·32	268¾	306½
†Roxana of Yalart ..	2694	17.7.12	26.7.12*	223	2	3,747	4·3	161¼	184
†Lydia of Yalart ..	2721	22.7.12	29.7.12*	251	4	4,160	3·9	162¾	185½
Lily II. of Oakvale ..	2720	22.7.12	31.7.12*	204	2	5,403	3·99	215¼	245½
†Fury of Yalart ..	2716	24.7.12	1.8.12	195	1	4,082	4·56	186¼	212¼
†Peggy of Yalart ..	2724	24.7.12	1.8.12	248	3½	4,659	4·53	211	240½
†Amy of Yalart ..	2603	27.7.12	3.8.12	247	7	4,583	4·4	201½	229¾
†Optic of Yalart ..	2723	6.8.12	13.8.12	194	1½	3,632	4·43	161	183½
Lady Ada Douglas ..	2387	20.8.12	27.8.12	235	4	5,293	4·61	244¼	278½

* Weights not recorded earlier.
† Heifer.

LYON, GORDON, Heidelberg (JERSEY).

Cows Entered, 15; Term Completed, 9; Certificated, 8.

Name of Standard Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk Last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.
Lassie II.	1136	10.5.12	7.6.12*	273	19½	6,650	4.9	326¼	372
Kathleen II.	1104	26.6.12	3.7.12	273	13½	5,452	4.75	258¾	294¼
Silvermine V... ..	1386	4.7.12	14.7.12†	273	11½	5,645	4.66	263	300
Molly II.	614	16.7.12	23.7.12	273	17½	7,440½	4.85	361	411¼
Silvermine IV. ..	716	14.9.12	22.9.12†	273	20½	7,591¾	5.12	388	443¾
May II.	568	30.8.12	8.9.12†	273	11	5,804½	4.32	250¾	286
Lassie	509	12.9.12	22.9.12†	273	17¾	7,340	5.08	372¾	425
Audrey Lassie ..	825	2.9.12	9.9.12	273	10½	4,854¾	5.2	252½	287¾

* Had mammitis.
† Weights not recorded earlier.

KEAM, P. E., Heidelberg (JERSEY).

Cows Entered, 21; Term Completed, 8; Certificated, 6.

Name of Standard Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk Last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.
Fancy of Glenard ..	1939	11.7.12	18.7.12	248	3	3,419¼	6·05	206	235
Princess II.	Not yet allotted	23.7.12	11.8.12*	273	13½	5,783	4·27	246¾	281
†Olive	"	15.8.12	22.8.12	247	11¼	3,962¼	5·66	224½	256‡
Lady II.	2158	16.8.12	28.11.12*	273	16½	7,019	4·24	298	339
Wilful Venture ..	Not yet allotted	20.8.12	31.8.12*	273	14½	6,381½	5·95	379¾	433
Jersey Maid.. ..	2114	31.8.12	7.9.12	273	10	4,122¾	5·34	230	262¼

* Weights not recorded earlier.
† Heifer.
‡ 247 days' test, as first 26 days' weights not furnished.

DEPARTMENT OF AGRICULTURE, Boisdale (RED POLLS).

Cows Entered, 9; Term Completed, 4; Certificated, 4.

Name of Standard Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk Last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs.
Havana	Not yet allotted	21.8.12	28.8.12	256	2	6,060¼	4·17	253	283¼
*India	"	27.8.12	4.9.12	267	7	5,231	4·55	238¼	271½
Cigarette	"	15.9.12	22.9.12	273	6	6,813	4·00	278½	317¼
Pennsylvania ..	"	16.9.12	23.9.12	228	3	4,979¾	4·32	215	245¼

* Heifer.

READ, J. D., Springhurst (JERSEY).

Cows Entered, 14; Term Completed, 10; Certificated, 9.

Name of Standard Cow.	Herd Book No.	Date of Calving.	Date of Entry to Test.	No. of Days in Test.	Weight of Milk Last Day of Test.	Weight of Milk.	Average Test.	Butter Fat.	Estimated Weight of Butter.
					lbs.	lbs.		lbs.	lbs
Graceful Magnet of Springhurst	2058	18.7.12	25.7.12	273	10½	5,887	5·13	302	344
Beauty of Springhurst	1567	31.7.12	7.8.12	273	13½	5,388	5·27	283¾	323¼
Alsyke of Springhurst ..	1515	6.8.12	13.8.12	273	13¼	4,837	5·17	250½	285½
Stockings of Springhurst	2683	10.8.12	17.8.12	273	13½	5,047	5·27	266	303¼
Euroa of Springhurst ..	1918	15.8.12	22.8.12	273	6¼	5,007	5·08	254½	290
Dulcie of Springhurst ..	1878	15.8.12	22.8.12	273	13	5,276	5·53	291¾	332¾
*Daphne of Springhurst	1803	19.8.12	27.8.12†	273	12½	3,917	5·75	225½	257
Aster of Springhurst ..	1540	17.9.12	27.9.12†	273	5¼	4,921	5·17	254½	290¼
*Tulip of Springhurst ..	2730	19.9.12	27.9.12†	273	6½	4 550	5·63	256¼	292

* Heifer.
† Weights not recorded earlier.

BRISBANE, W. P., Weerite (Aryshires)—

Cows entered .. .. 16 Term completed .. .. Nil

Cows are doing well, but none has yet completed the term, as the herd was only entered in March this year. The figures available indicate that the herd contains some particularly high yielders.

CURNICK, F., Malvern (Jersey)—

Cows entered .. .. 2 Term completed .. .. Nil

These two cows are mother and daughter, and are both well over amount required for a certificate, though term not yet completed.

GEELONG HARBOR TRUST (Aryshires)—

Cows entered .. .. 9 Term completed .. .. Nil

Only recently entered.

WOODMASON, WM., Malvern (Jersey)—

Cows entered .. .. 13 Term completed .. .. Nil

As this herd is of comparatively recent entry, no completed record is available, but the figures already in possesion of the Department are sufficient to show that many members of the herd will prove their utility.

ROBINSON, T., Ivanhoe (Aryshire)
SADDLER, D., Camperdown (Aryshire)
MANIFOLD, W. T., Purrumbete (Shorthorn)
MCGARVE, W. A., Pomborneit (Jersey)
STONE, A. R., Brighton (Jersey)
BECKWITH, B. M., Kooyong (Dexter Kerry)

Entry too recent for test to be recorded in this report.

REGULATIONS CONCERNING HERD TESTING

FOR THE

GOVERNMENT CERTIFICATION OF STANDARD COWS.

ENTRANCE.

1. The owner of any herd of pure bred dairy cattle may submit his herd for certification.

2. Only those cows registered in a recognised herd book or pure stock register will be accepted, and all such cows in the herd must be tested, with such exceptions as are set out in clauses 14, 15, and 16.

3. An annual fee of £1 per herd and 5s. per cow tested shall be paid to the Department of Agriculture on demand.

4. Any cow entered for certification may be branded in such manner as to insure identification, and all standard cows will be marked on the inside of an ear with the Government tattoo mark and an identification number.

LACTATION PERIOD.

5. Testing and recording shall occupy a period of nine calendar months, commencing one week from date of calving, excepting under such circumstances as set forth in clause 18. This period shall be recognised as the official lactation period.

RECORDING.

6. The milk from each cow entered shall be weighed separately immediately after each milking by means of tested and approved scales, and the weight recorded on a printed chart supplied for the purpose, which shall remain the property of the Department. Such scales and chart shall be available for inspection by a Government Dairy Supervisor when required.

SUPERVISION.

7. A Government Dairy Supervisor, under the direction of the Chief Veterinary Officer, will make periodical visits for the purpose of checking records and taking samples of milk for testing. There shall be not less than nine visits during the official lactation period, and not more than thirty days shall elapse between any two visits. Additional visits may be made at any time by the Supervisor for the purpose of taking supplementary records and samples for testing as often as may be deemed advisable.

8. Every facility shall be afforded Government Officers in carrying out their duties under these Regulations, and accommodation must be provided over-night when required.

9. Particulars as to date of calving, service, drying-off, hours of milking, manner of feeding, must be supplied for record purposes on request of the Dairy Supervisor. If deemed necessary in any case, the owner may be called upon to furnish a statutory declaration as to the correctness of such or any particulars.

TESTING.

10. In collecting samples for testing, the morning and evening milk will be taken; the tests will be made by the Chemist for Agriculture or his Deputy from a composite sample containing quantities of the morning and evening milk proportionate to the respective yields, and the results, unless shown to be abnormal, shall be considered as the average for the period intervening since the next previous normal test. If apparently abnormal, the results may be discarded, and further samples taken and tests made.

STANDARD COWS.

11. Standard cows under these Regulations shall be those which, during the official lactation period, yield—

(*a*) in the case of cows commencing their first lactation period and being then under 3 years of age, 150 lbs. of butter fat;

(*b*) In the case of cows commencing their first lactation period and being then over 3 years of age, 200 lbs. of butter fat;

(*c*) in the case of cows of any age commencing any lactation period other than the first, 200 lbs. of butter fat.

CERTIFICATION.

12. A Government Certificate shall be issued in respect of all standard cows. Such certificate shall show the breed, the age at entry, brands, the official lactation period recorded, and date of completion, the weight of milk given, the amount of butter fat and commercial butter (estimated on a 14 per cent. overrun), and the weight of milk given on the last day of the official lactation period.

13. The Certificate issued in respect of any standard cow shall, if she attain the standard during any subsequent official lactation period, be returned to the Department, when a fresh certificate will be issued, which shall show her record for each and every lactation period in which she was tested.

Exemptions.

14. Cows eight years old or over whose yields have been recorded for three official lactation periods may be exempt.

15. Aged or injured cows in the herd at time of entry, and kept for breeding purposes, may be exempt on the recommendation of the Government Supervisor. Any injury interfering with lactation received subsequent to entry may be recorded on Certificate issued.

16. Any cow which, on veterinary examination, is found to be affected with tuberculosis shall be withdrawn from the test, and her milk shall not be allowed to be used for sale, or for the preparation of any dairy produce for sale.

17. Any cow which, on veterinary examination, is found to be affected with actinomycosis of the udder, or any other disease or condition which may temporarily render her milk injurious, may remain in the herd for testing, but her milk shall not be used for sale or for the preparation of any dairy produce for sale without permission of the Supervisor.

18. When any newly-calved cow is rendered temporarily unfit for testing by being affected with milk fever, mammitis, retention of placenta, or other ailment affecting newly-calved cows, the period elapsing between the calving and entrance to the official lactation period may be extended on the recommendation of a Veterinary Officer or Supervisor, but such period shall not exceed one month from date of calving.

19. Any interpretation or decision in respect of these Regulations, or in respect of any matter concerning the Certification, which receives the written approval of the Director of Agriculture, shall be final.

20. Should the owner of any herd entered not conform to these Regulations, such herd shall be subject to disqualification for such period as the Minister shall determine. The Minister retains the right to withdraw any Certificate when, to his satisfaction, good and sufficient cause is shown.

SEPARATING TEMPERATURES.

In a recent issue of *Hoard's Dairyman*, Mr. J. H. Monrad, of Denmark, gives some interesting notes upon the effect of temperature on the work of the cream separator. In Denmark cream and skim milk must, under the law, be heated to at least 176 degrees Fahr. for pasteurizing, and thus the milk can be separated at a high temperature if this is desirable. As a fact, the normal separating temperature in Denmark may be placed at about 131 degrees. Experiments at the Royal agricultural laboratory in 1910 showed, however, that this temperature was little superior to 95 degrees, which is about the temperature of freshly-drawn milk, the difference amounting to only .006 per cent. in favour of the warmer milk. The difference, however, became much more pronounced when the temperature was allowed to drop below 95 degrees, and German experiments are quoted showing that at 86 degrees there was .2 per cent. fat left in the milk, at 68 degrees there was .3 per cent., and at 50 degrees there was .6 per cent. left. Altogether, the data quoted show that freshly-drawn milk is warm enough for practical purposes, but that when the milk has been cooled by standing, the work of the separator is decidedly less efficient.

THE FRUIT TRADE OF VICTORIA:

ITS PRESENT STATUS FROM A COMMERCIAL STAND-POINT.

(*Continued from page* 511.)

PART X.—PACKING.

By E. Mecking, Senior Fruit Inspector.

A PLEA FOR THE INTRODUCTION OF THE DIAGONAL-NUMERICAL SYSTEM OF PACKING APPLES.

The old adage "Show me a man's friends and I'll tell you his character," may well be transposed for application in a business sense by saying "Show me a man's goods and I'll judge his commercial status." This is particularly the case in an industry such as our oversea fruit export trade, in which our fruits are consigned to markets at the other end of the world, and where the buyer (who seldom or never comes into personal contact with the producer or seller) has no standard whereunder he may judge the commercial standing of the latter except by the general appearance and quality of his wares. The contention often quoted by many of our exporters, that buyers on the London and Continental markets take no note of the appearance and make-up of the packages enclosing our fruits, but that these solely judge the fruits on their own merits, is not altogether correct. Packages encasing commodities such as fresh fruits which are sold in their original containers are, from a marketing point of view, part and parcel of the goods themselves, and the attractiveness, or otherwise, of the packages may rightly be considered as having a great influence on the mind of the buyer—in short, to be a factor of prime importance in determining the value of the goods. Fruits carefully graded with regard to size, colour, and general quality, put up in distinctive and attractive packages, and branded with grade marks, in a sense, sell themselves, as they save the agent and buyer an infinite amount of trouble in determining their value. Of course, bad fruit cannot be expected to realize high prices, even if enclosed in good packages, but, all other things being equal, there is little doubt that consignments put up in attractive manner will realize better prices than will consignments where such has been neglected.

The object is to show that up to now sufficient consideration has not been given by our exporters to this aspect of the subject, nor, also, to the fact that the introduction of new and improved methods, both in the style of package used and in the manner in which our fruits are packed, is of urgent necessity if we wish to maintain the position we have already established in connexion with our oversea fruit export industry on the London and Continental markets. It is intended to further show that the best means whereby this desirable end may be attained will be by the general adoption of the so-called numerical system of packing fruit.

HISTORY OF NUMERICAL PACKING.

This system originated some years ago in California in connexion with the packing of oranges for transport over long distances. The

pack, which was termed the "diagonal pack," was not at first instituted with the idea of adopting a numerical standard, but was used because it furnished the best system of putting up fruits with the maximum of tightness combined with a minimum of bruising. It was later discovered that, in order to put up fruits of various grades, a numerical system of packing could be applied under the diagonal pack. After California had been packing for some time under the numerical system, the advantages, from a marketing point of view, were so obvious that the system gradually spread through the Western States of the United States and Canada, being voluntarily adopted by the growers themselves, and its superiority over the older methods is now so universally acknowledged that it has been made the subject of legislation within the past three or four years in both countries of the American Continent.

CAPACITY STANDARDS AND NUMERICAL STANDARDS CONTRASTED.

In this country an attempt has been made to protect the purchaser by the passage through the Legislature in 1906 of the Fruit Cases Act. Under this measure, cases of various sizes based upon the imperial bushel standard have been adopted. In order to suit the packing of different varieties of fruits, and also to meet the varying requirements of the local, Inter-State, and oversea export trades, these packages vary in shapes as well as measurements; but the cubical capacities of all cases have been fixed to provide that, as nearly as possible, these shall contain, by measurement, either two bushels, one bushel, or one-half bushel of fruit as may be required. Although these standards by measurement are a great advance on the old haphazard methods of putting up fruits in any sized packages, and although they have proved of much benefit to the trade by suppressing, or, at least, lessening the dishonest practice of selling fruit in undersized cases, yet it would appear that, for many fruits to which a numerical standard may be applied, the capacity standard does not nearly give so good a guarantee to the purchaser as does the numerical standard. This is particularly so when, under the numerical system, the purchaser becomes thoroughly acquainted with the meanings of the trade descriptions which are placed on the outside of packages. Before proceeding to explain why this is so, it may be well to state that, while the wholesale trade, and particularly the oversea export section of that trade, is under review, yet the numerical system is also eminently adapted for a local single case retail trade. In the Western States of the North American Continent, two sizes of cases, or boxes, as they are termed in America, have in the past been generally adopted by the growers for numerical packing. These are respectively called the "standard," or Washington box, and the "special," or Canadian box. The inside measurements of these boxes are as follows:—

"Standard" (Washington), 10½ in. x 11½ in. x 18 in. = 2,173 cubic inches.

"Special" (Canadian), 10 in. x 11 in. x 20 in. = 2,200 cubic inches.

They are usually constructed of spruce or pine cut as follows:— Ends, ¾ in.; sides, ⅜ in. (one piece each). Tops and bottoms (two pieces each), 3-10 in. to ¼ in., according to the strength of the material used. Growers in the Western States of America in the past used both boxes, because it was considered that both sizes of packages were

necessary to provide for the packing of all grades of fruit. This idea is now, however, discarded, as it has been found that for all practical purposes the Canadian case is sufficient. For shipping purposes they should go twenty-four boxes to the ton (40 cubic feet measurement). The tops and bottoms are fastened with four cleats, each ⅜ in. x ¾ in. x 11 in.

GENERAL DESCRIPTION OF VARIOUS KINDS OF NUMERICAL PACKS.

In packing under the numerical system, three kinds of pack are used, viz., *the 2-1 pack, the 2-2 pack, and the 3-2 pack.* The 2-1 pack is so called because the fruits, in counting the rows laterally, are arranged from one end of the box to the other in two long rows, plus one short row, or two short rows, plus one long row, as the case may be. *It thus takes three apples to reach diagonally across the full width of the box.** This pack is seldom used in the Canadian box, as this

PLATE I.

Fig (*a*).
2 × 2 pack, 4 tier, 6–6 rows
24 apples to tier
4 tiers=96 apples to case.

Fig. (*b*).
2 × 2 pack, 3½ tier, 4–4 rows
24 apples to tier
64 apples to case.

box is too wide to permit any but the largest sized apples to reach right across the case in diagonal rows of three. It may, however, be widely used in the Australian so-called "dump" case. In the 2-2 pack the fruits are arranged in rows of two across the box. It thus takes four fruits of this pack to reach diagonally from one side of the box to the other (Plate I.). In the 3-2 pack, if the count is commenced at one end of the box and counted horizontally to the other end, it will be seen that the apples are arranged horizontally in rows of 3's and 2's alternately, and that it takes five fruits to reach diagonally from one side of the box to the other (Plates II. and III.). The fruits in all the above packs should be so arranged that the rows run in direct lines lengthways, and also in straight lines diagonally. For instance, in describing a pack, we might say that it was a 2-2, 4-4, or a 3-2, 8-8 pack. This would indicate that in the first instance there *would be four rows with four fruits in each row, making a total of*

* Seen in subsequent article, Plate VI.

sixteen to a layer (Plate I., Fig. *b*). As in the Canadian case, all 2-2 packs are four layers, or tiers, as they are named in America, deep, we would thus, in the pack under notice, have 16 x 4, or a total of 64 apples to the case. In the second instance there would be two rows containing eight fruits, and three rows containing eight fruits= 8 + 8 + 8 + 8 + 8, making a total of 40 fruits to the tier. With five tiers of apples in the case, this would give us 40 × 5=200 fruits to the case (Plate II., Fig. *a*). In the 2-1 and 3-2 packs a variation in the number of apples to the tier is often necessary. These will be described more fully later in the explanatory notes on the various schedules. To start the 2-1 pack, the first fruit must be placed in one of the corners at the end of the box nearest the packer. The left-hand corner is the one usually chosen for this and all other packs. The second fruit should be placed in the opposite right-hand corner.

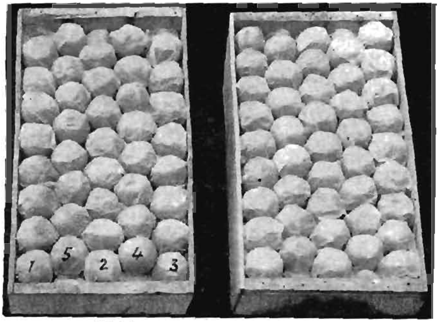


Fig. (*a*). Fig. (*b*).

PLATE II.

3 × 2—5 tier packs.

(*a*) 8 × 8 rows, 5 tiers to case=200 apples.

(*b*) 8 × 9 rows, 5 tiers to case=213 apples.

The third fruit should be placed between these two fruits, and the fourth fruit should be placed in line with fruit No. 1 (*i.e.*, in the left-hand corner), at the end nearest the packer.* To start the 2-2 pack, the first fruit should be placed in the left-hand corner of the end of the case nearest the packer. The second fruit should be placed against the end of the box about midway between the edge of the first fruit and the opposite side. The third and fourth fruits are fitted into the spaces between the first and second placed fruits (Plate I.). If these first four apples are carefully packed, the rows of the tier fill easily. In the 3-2 pack, a fruit is placed in each corner, with a third apple midway between. The fourth and fifth fruits are placed in the two spaces between the first three fruits (Plates III. and VI.). In all these packs, when the first tier is completed, it should be sufficiently tight to permit the box being held on

* Seen in subsequent article, Plat. V.).

end without the fruit falling out. To obtain the requisite tightness of the first tier, the apples should be placed in position rather loosely until the apples in the last rows of the tier are to be placed in the case. The portion of the tier already packed should then be tightened by the packer inserting his hands at the end of the tier and pulling the apples towards himself. The remaining appples required to complete the tier should then be inserted at the end of the case farthest from the packer. After the first tier has been packed, the second tier should be so packed that no fruits in this tier should directly rest upon the fruits in the tier below. This principle should be observed throughout, until the packing of the box is completed. The rows should be straight, both lengthways and diagonally.

The apples must be carefully selected with regard to uniformity in size, colour, and general quality, if an attractive and properly packed case of fruit is desired. If the fruits are not carefully selected with regard to equality in size before being placed in the case, the

Fig (a)—1st, 3rd, and 5th tiers=38 apples to tier.

Fig. (b)—2nd and 4th tiers=37 apples to tier.

PLATE III.

3 × 2 pack, 4½ tiers, 8–7 rows, 38 and 37 apples to alternate tiers—5 tiers=188 apples.

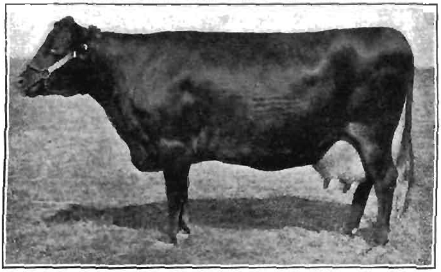
required number corresponding to the grade of the fruit cannot be packed. For example, if it was intended, when commencing to pack the case, to pack 175 fruits, this could not be accomplished if the packer were to introduce fruits which rightly belong to the grade which would run 200 fruits to the case. He would discover that his pack would be thrown out of line in many directions, and a buyer on examining the top layer would know at a glance that the case was incorrectly packed, even if the trade description indicated that the case contained the requisite number (175 fruits).

(To be continued.)

RED POLLS FOR DAIRYING.

By Dr. S. S. Cameron, Director of Agriculture.

As milkers, the Red Poll herd established by the Department of Agriculture four years ago is maintaining the early promise of becoming a factor in the improvement of the dairy herds of the State. It will be recalled that in 1910-11 the average milk yield of the herd for an average milking period of thirty-seven and a half weeks was 5,750 lbs., and in 1911-12, with an average milking period of forty weeks, 6,355 lbs. For the year just closed, 1912-13, the records are still very good, although the average (5,218 lbs.) is somewhat lower, on account of the inclusion in the herd of a number of heifers milking for the first time, and also because of the untoward conditions under which the herd was milked for the greater part of the year, the summer drought at Boisdale and the dry, scant pastures at Rutherglen



One of Lord Rothschild's Red Poll Milkers.

Milk yield 1908, 10,186 lbs.; 1909, 9,595 lbs.; 1910, 11,450 lbs.

being markedly detrimental to record-raising. A feature of the herd, however, which is even more satisfactory than the comparatively high milk yield under the adverse conditions, is that the butter fat tests have been as uniformly high this season as during previous seasons.

In 1911-12, the average test ranged from 4.31 to 5.95, the three highest cows going 5.2 to 8.2 (Vuelta), 4.4 to 8.4 (Cuba), and 4.5 to 7.0 (Muria). Three other cows regularly tested over 6 per cent. towards the close of their milking period, viz.: Connecticut, 4.6 to 6.4; Beulah, 4.9 to 6.4; and Bullion, 4.8 to 6.2. This season (1912-13) the high testing capacity of the herd has again been demonstrated, and two heifers, viz., India and Birdseye, have run the best of the older cows very close for the record of the herd. India's test has ranged from 4.1 to 6.2, and Birdseye's from 3.9 to 8.0, the latter on three successive evening milkings giving the extraordinary tests of 9.4, 9.5, 9.7. All the tests referred to above, and set out in the tables below, are composite tests of the morning's and evening's milk taken under Government standard conditions. Some of the heifers, too, appear likely to carry on the fame

of their dams as regards milk yield, Goldleaf, a daughter of Bullion (7,733 lbs. record), having yielded 6,437 lbs. during the Standard Test period of nine months, with a butter fat test ranging from 4.1 to 5.3. She calved at two years and two months old, and is due to calve again at three years and one month. Her yield of butter fat, viz., 308.5 lbs., is so far the best of all the heifers that have completed the nine months' milking under Standard Test conditions.

Satisfaction appears to have been given by the system that has been adopted for fixing the price of the bull calves, viz., the value of the annual butter fat yield of the dam at 1s. per lb. Thus Bullion yielded 357 lbs. of butter fat, and her calf was sold at £17 17s.; Havana yielded 230 lbs. of butter fat, and her calf was sold for £11 11s. Bull calves ex cows on their first milking, and in respect of which there is therefore no record available other than that of the grand dam, are sold for a uniform price of 5 guineas; and this last season the purchasers under

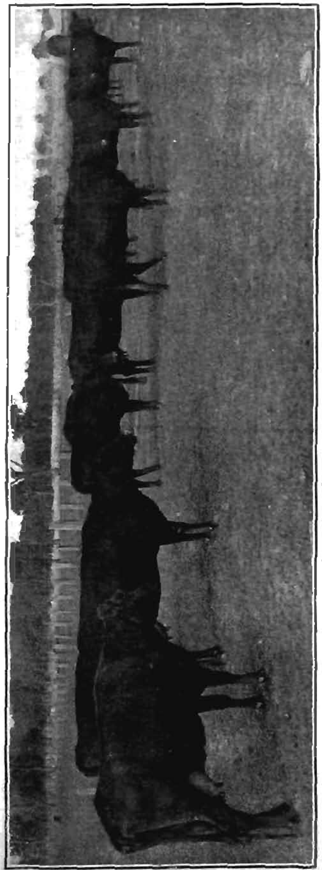
"Vuelta," one of the Department's High Testing Cows.

Milk yield 1911-12, 41 weeks, 7752 lbs.; butter fat test 1911-12, 5.2 composite minimum, 8.2 composite maximum; butter fat yield 1911-12, 485.1 lbs.; butter fat value 1911-12, £26 5s. 9d.; commercial butter 1911-12, 553 lbs.

these conditions of the Goldleaf and Birdseye calves may be considered fortunate. Three guineas additional is charged if the calves are kept till over twelve months old; but this has occurred in only one case, each season's drop having been disposed of as calves. Details of the bull calves available are advertised in the *Journal* as the drop proceeds, and those which are bespoken are reared for delivery at six months. If a calf does not rear well, a second choice is allowed, but so far no purchaser has had occasion to take advantage of this.

Reports from breeders who purchased the earlier calves show that upwards of 90 per cent. of the calves got by the Red Poll bulls, ex crossbred cows, or cows of other breeds, are hornless, and 75 per cent. are whole red in colour.

The characteristic feature of the breed, viz., hornlessness, is destined, in the opinion of the writer, to play an important part in the economics of dairying in Australia. With the gradual increase in the expensiveness of hired labour, the cost of stall feeding dairy cows is becoming

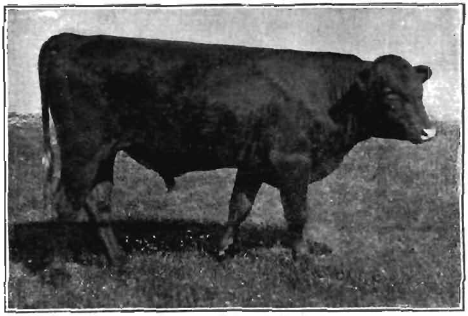


A Section of the Departmental Herd.

almost prohibitive, and yet hand feeding or artificial feeding in some form must be carried on if the butter yield is to be maintained or increased. For this country must adopt the practice of growing and conserving fodder in the spring for feeding in the autumn and winter if it is to continue to compete successfully in the butter export trade. The period of lactation of cows must be lengthened to increase profits to a degree commensurate with high land values and costly labour: *winter dairying* must be carried on to avoid the present baneful break in our supplies to the London market; and neither of these things can be done if dependence is placed on pasture alone and without hand feeding.

With horned cattle, *for hand feeding to be successful, they must be stalled and fed separately.* If dehorned, or hornless, they may be fed with half or less labour from troughs or racks in open sheds, or yards, or paddocks. When deprived of their horns, cattle cease the disastrous butting and ripping of one another which is so common a sight in cow-yards, and the damage done by the bully of the herd, if such exists, is negligible. On one of the large dairy farms along the Murray in South Australia a dehorned herd of 100

Showing evenness of type.

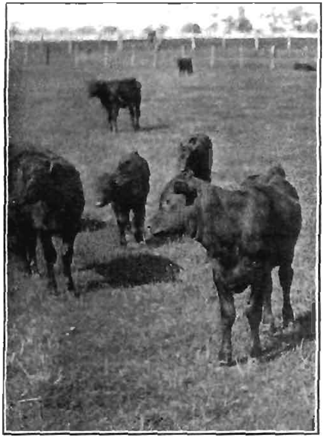


" Vuelta's " Son as a Yearling.

" Nicotine " as a Yearling.

milking cows is kept continuously on a paddock of 30 acres, being fed with green lucerne and lucerne hay deposited from a waggon over the fence into long lengths of troughs, out of which the fodder is eaten by the cows comfortably ranged up side by side.

Lest some dairymen, who sight the advantage of conserving labour in hand feeding in the way suggested above, may be led into trouble, it is necessary to mention that dehorning has been decided by the Courts of this State to be illegal. Consequently, if hornless cattle are wanted, it is necessary to breed them hornless, and it was with a view of giving a lead in this matter that the Department undertook the experiment of establishing a herd of polled milkers. The breed has been



Some of the Season's Drop.

developed as a milking herd in England for many years, Lord Rothschild's herd at Tring Park being notable as deep milkers. But in Australia they have hitherto been mainly known as a beef breed, reputed for their quick conditioning, and it was with some misgiving that the experiment was undertaken. So far the indications are that the milking function is inherent in the breed, and the records published during the last two years, as well as those set out in the tables following, appear to show that the cross may be introduced into ordinary dairy stock without any risk of a diminished milk yield. At any rate, results so far afford ample justification for the departure made by the Department and for its continuance.

YIELDS AND RETURNS OF THE GOVERNMENT HERD OF RED POLL DAIRY CATTLE.

Season 1910–11.

Cow.	Days in Milk.	Weeks in Milk.	Milk in lbs.	Tests.	Butter Fat.	Commercial Butter.	Values.		
					lbs.	lbs.	£	s.	d.
Vuelta	270	38½	556	7·0–7·8	405·14	461½	17	10	10
Bullion	283	40½	773	4·2–5·0	356·71	406½	15	17	10
Connecticut ..	283	40½	818	4·2–4·6	269·06	306¾	11	17	4
Virginia.. ..	283	40½	636	3·8–4·6	254·75	290½	11	5	1¼
Carolina ..	283	40½	570	4·2–4·8	253·14	288½	11	3	4¼
Havana.. ..	283	40½	575	3·8–4·6	229·97	262¼	10	5	0¾
Cuba	283	40½	526	4·2–4·8	231·89	264¼	10	5	11
Muria	263	40½	548	4·2–6·2	240·70	274½	9	14	9¾
Kentucky ..	245	36½	531	4·0–4·6	225·98	257½	9	12	7
Cigarette ..	238	34	504	4·0–4·6	211·61	241¼	8	18	9
Beulah	135	19¼	397	4·2–4·9	200·44	228½	8	5	2
Pennsylvania ..	270	38½	461	4·0–4·4	189·75	216¼	8	4	3¼
Average for 12	261	37½	575·0	4·4	255·77	291½	11	1	9

Season 1911–12.

Cow.	Days in Milk.	Weeks in Milk.	Milk in lbs.	Tests.	Butter Fat.	Commercial Butter.	Values.		
					lbs.	lbs.	£	s.	d.
Vuelta	289	41¼	775	5·2–8·2	485·1	553	26	5	9
Connecticut ..	283	40½	678	4·6–6·4	364·0	485	19	11	10
Bullion	305	43½	694	4·8–6·2	344·0	392¼	18	10	7
Beulah	278	39¾	646	4·9–6·4	342·6	390½	15	3	6
Cuba	304	43½	701	4·4–8·4	337·8	385	18	10	4
Cigarette ..	291	41½	648	4·0–5·6	285·9	326	15	14	6
Sumatra ..	293	42	666	4·0–5·0	284·2	324	15	6	2
Kentucky ..	277	39½	669	4·0–4·8	277·7	316½	15	1	1
Muria	286	41	580	4·5–7·0	275·7	314¼	14	14	10
Pennsylvania ..	318	45½	634	4·0–5·2	271·9	310	14	13	10
Carolina ..	226	32¼	580	4·0–5·0	254·3	280	13	11	4
Virginia.. ..	277	39½	551	3·9–4·6	221·7	252¾	12	0	7
Havana ..	262	37½	535	3·8–4·5	215·3	245½	11	15	4
Average for 13	283	40½	635·5	4·7	304·6	346¼	16	4	7

Season 1912–13.

Cow.	Days in Milk.	Weeks in Milk.	Milk in lbs.	Tests.	Butter Fat.	Commercial Butter.	Values.		
					lbs.	lbs.	£	s.	d.
Muria	256	36½	578	4·5–7·3	314·96	359	15	15	0
*†Goldleaf ..	273	39	643	4·1–5·3	308·50	351¾	15	8	6
Bullion	239	34	649	3·8–6·8	296·90	338½	14	16	10
Virginia.. ..	259	37	650	3·6–5·7	282·56	322	14	2	6
†Cigarette ..	273	39	681	3·9–4·8	278·56	317½	13	18	6
Connecticut ..	320	45¾	610	4·0–7·6	277·85	316¾	13	17	10
‡Vuelta ..	263	37½	665	3·5–5·3	273·81	312	13	13	9
†Egypta ..	273	39	630	3·7–5·2	269·22	307	13	9	3
†Cuba	251	36	628	3·9–5·4	269·11	306¾	13	9	1
†Kentucky ..	266	38	624	3·4–4·4	256·00	291¾	12	16	0
†Havana ..	258	37	606	3·5–5·5	252·95	288½	12	12	11
*†Birdseye ..	273	39	435	3·9–8·0	250·34	285¼	12	10	4
Sumatra ..	230	33	567	3·7–5·5	238·37	271¾	11	18	4
*†India ..	268	38¼	523	4·1–6·2	238·16	271½	11	18	1
*Persica ..	252	36¼	419	4·6–7·7	218·69	249¼	10	18	8
†Pennsylvania ..	230	34¼	497	3·8–5·9	215·09	245¼	10	15	0
Europa	324	46¼	459	3·6–7·1	201·13	229¼	10	1	1
Carolina ..	274	39	445	3·6–6·5	198·30	226	9	18	3
*Turka	191	27¼	359	4·6–5·9	178·27	203¼	8	18	3
*Mexicana ..	210	30	383	4·0–5·1	171·58	195½	8	11	6
*Regalia ..	338	48¼	338	4·4–6·0	161·58	184¼	8	1	6
*Cabana ..	273	39	337	4·0–5·4	153·23	174½	7	13	3
*La Suelta ..	241	34½	266	4·3–8·2	134·23	153	6	14	3
Average for 23	262	37¼	521·8	4·5	236·49	269	1		5

* Heifers on first calf.
† Records under *Government standard test conditions.*
‡ Suffered from eye accident for a considerable period.

CONCRETE ON FARMS.

(A) Concrete Silos.

By J. Wilson, Silo Builder.

The advantage derived from the construction of silos by using concrete bricks made from the material found on most farms, namely, gravel and sand, with the addition of a proportion of cement (six of sand to one of cement), is steadily being recognised. The silo so built is fireproof, white ant and mouse proof, as well as being durable. The proportion of cement used is so small that it is hardly noticeable in the matter of cost, only sixteen casks of cement are used to make

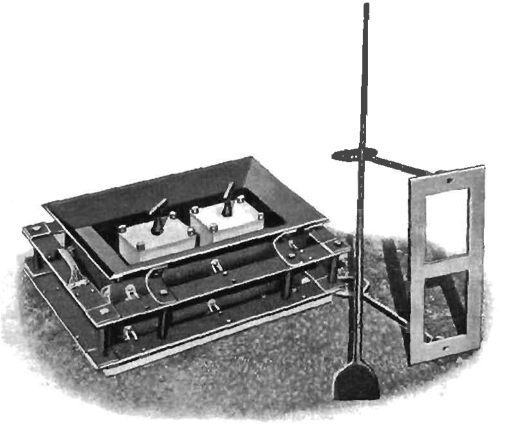


Fig. 1.—Brickmaking Machine.

the bricks and set them in a 70-ton silo. Farmers who elect to build silos or farm buildings generally for themselves with the aid of farm labour can now do so with a brickmaking machine and the use of average intelligence. The necessary material, sand and gravel, or sand, is usually to be found close at hand. The sand should be sharp. and washed clean, as both clay and loam are drawbacks, particularly the former. An up-to-date machine made entirely of steel can be had for a nominal sum. The machine makes a hollow brick 24 in. x 6 in. x 6½ in., and is lifted from the brick, thus preventing any possibility of the block becoming cracked or strained. The weight of a single brick is about 30 lbs., and considerable care and thought

has been expended over the construction of the machine; its usefulness for silos or buildings is fully assured.

To build a 70-ton silo, 850 blocks of the size mentioned are required, and one man, with the assistance of a lad, can make them in a week, and the building should not occupy more than ten to twelve days to erect. The bricks must be properly cured before laying; this is accomplished by sprinkling them with water night and morning for a fortnight, so as to prevent them from drying too quickly. In building, the blocks are set in cement mortar of a mixture made of four parts of sand to one part cement in the same manner as ordinary bricks. It is advisable not to mix more mortar than can be used in half-an-hour, as set or hardened cement mortar is quite useless. To insure success, the initial set should not be disturbed.

Foundations.

Level a site for a diameter of 16 feet, fix a centre point by placing a 2-in. pipe firmly in the ground, so as to receive a 2-in. pole; from this centre attach a piece of quartering, 7 ft. 4 in. long, to act as a trammel which will describe a circle having a diameter of 14 ft. 8 in. inside measurement. Care should be taken to fix the pole plumb so *as to obtain an accurate circle. Cut out a trench 6 inches deep and* 12 inches wide, the bottom to be level. A double wall is laid in the trench for the first course, and then single walls to the top.

The blocks break joints at 12 inches in succeeding courses, which allow the hollows in the bricks to come over each other.

Reinforcing.

During the course of construction the walls should be reinforced by laying on the top of each course ordinary fencing wire (any old wire lying about the farm will answer the purpose), clipped together at joints, and built in with the blocks. Three rows of wire to each course for the first 4 feet, and for the remainder two rows of wire. The height of a 70-ton silo is 21 feet, and inside diameter 14 ft. 8 in., and requires 850 bricks, each 24 inches long, of this number 45 would be required to form the footing course. Port holes, or doors, are formed in the following manner:—The first or bottom door commences six courses from the ground, one brick being left out for four courses; there are three such doors to a silo, allowing six courses between each door, size of opening will be 2 ft. x 2 ft. Form the doors of galvanized iron, 24 gauge, cut 3 ft. x 2 ft. 6 in., and nailed to three strips of 3-in. x 1½-in. hardwood 2 feet long. Door frames are built of 6-in. x 1½-in. hardwood, and checked out 1½ inches to receive ledgers of doors.

The inside face should be bagged smoothly, so as to be free of mortar projections, and the joints of exterior struck smoothly with a trowel.

Build in on the top course of bricks eight bolts, each 10½ in. x ½ in. long, for bolting down the plates of the roof, four plates of 4 in. x 2 in. are used, and the purlins are propped up with 4 in.

x 2 in. studs, bolted to the plates at the bottom, and halved out 2 inches at the top, to receive purlins. Fix two braces 3 in. x 1½ in. from centre studs to ridge purlins; two purlins are used to form ridge. All timber used is of hardwood. Cover with corrugated iron, 9-ft. sheets, and fasten with spring head nails, nailing the iron every second corrugation. The concrete silo is one of the types erected for farmers, on terms, by the Department. Application forms for the construction can be obtained from the Department of Agriculture, Treasury Buildings, Melbourne, together with particulars of the general conditions under which the silo is erected. The cost of erecting a 70-ton concrete silo complete, with elevator, is £55, subject to slight variation on account of distance from Melbourne and cost of cement.

Material Required for a 70-ton Concrete Silo.

Hardwood, 4 in. x 2 in., six 18 feet, three 16 feet, purlins plates and studs.
Hardwood, 6 in. x 1½ in. three 9 feet, door frames.
Hardwood, 3 in. x 1½ in., two 18 feet, braces for roof.
Galvanized corrugated iron, 26 gauge, 9 feet, eighteen sheets.
Galvanized plain iron, 24 gauge, 72 in. x 36 in., three sheets.
Galvanized ridging, 26 gauge, 16 inches, 18 feet.
Spring head nails, 2½ inches, 3 lbs.
Wire nails, 3 inches, 5 lbs.
Cement, sixteen casks.
Sand, 16 cubic yards.
Bolts, nuts, and washers, eight 10½ in. x ½ in., two 6½ in. x ⅜ in., ten 4½ in. x ⅜ in.

Material for 30-ft. Elevator.

White deal, 6 in. x ⅞ in., T. and G., nineteen 20 feet.
White deal, 6 in. x ½ in., T. and G., four 15 feet.
Oregon, 6 in. x 1½ in., one 8 feet.
Chain, 60 feet, 1 9-16 pitch, No. 45 link.
Thirty Oregon slats and attachments for No. 45 link.
One 8-inch diameter sprocket wheel, 16 teeth, 1 9-16 inches pitch.
One 8-inch diameter x 11¾-inch pulley.
Two adjustable bearings.
One 22 teeth, 10½-inch diameter, sprocket wheel for No. 52 link, 1½-inch pitch.
One 10 teeth 5-inch diameter sprocket wheel for No. 52 link, 1½-inch pitch.
14-ft. chain 1½-inch pitch, No. 52 link.
Eight 2½-inch x ½-inch bolts, nuts, and washers.
Eight ¾-inch washers.
Two sheets 72 in. x 36 in., galvanized plain iron, 24 gauge.
4 lbs. 2-inch, 2 lbs. 3-inch, wire nails.

(B) Concrete Fence Posts.

The manufacture of concrete fence posts is yet in its infancy, but such posts undoubtedly show superiority over the wooden ones. They are usually made 7 feet long, 5 in. x 5 in. at base, tapering to 5 in. x 3 in. at the top, with holes placed at suitable intervals for either plain or barbed wire. To these concrete posts timber can be bolted to carry gates and any class of fence. Plain wire, barbed wire, or wooden pickets can be readily attached.

The machine for moulding the posts is constructed of steel throughout, with collapsible sides and ends, so that a man, with the

assistance of a lad, can make 100 posts per day of eight hours' labour. Reinforcing is recommended with some form of metal (old fencing wire, either plain or barbed, or hoop iron will answer the purpose). The superiority of such posts over wooden ones is self-evident. They

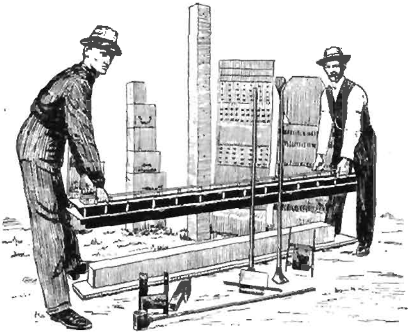


Fig. 2.—Making Fence Posts.

are fireproof and rot-proof; weeds, leaves, and rubbish which usually accumulate around the base of fence posts may be burnt without the slightest injury to the post. It is practically everlasting, and in many localities prove equally as cheap as a wooden post, since it must be remembered that the first cost of a wood post is not the only one; a

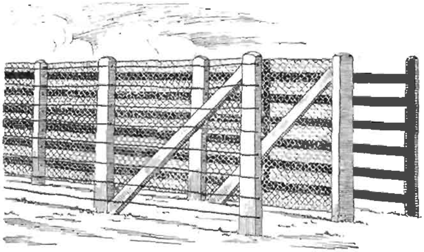


Fig. 3.—Different Kinds of Concrete Fences.

wood post may rot away or be burnt, and the cost of maintenance must be considered.

Posts of any size can be made in the moulding machine by blocking off at either end, and the fastening holes for each post can be regulated according to requirements.

THE VALLEY OF THE UPPER MURRAY.

By Alfred J. Ewart, D.Sc., Ph.D., Government Botanist of Victoria, and Professor of Botany and Plant Physiology in the Melbourne University.

This district exhibits several interesting features both from a botanical and an agricultural point of view. The particular portion referred to may be said to extend from Bethanga to Bringinbrong and Towong, where the head of the Murray divides into the Swamp River and the Indi River. Allowing for the windings of the river, the length of this portion of the valley is probably over 100 miles, and the width of the valley varies from 1 to 3 miles. All the surrounding country is of an old well-sculptured type. Opening into the main valley, particularly on the upper part, are lateral valleys of equal or even greater breadth, extending back in some cases for 10 or 20 miles, such as the valleys at Burrowye, Walwa, Corryong, and Cudgewa. The broad flood plains forming the floors of these valleys consist of rich alluvial soil, a large part of which is sufficiently raised above the river level to be liable only to occasional flooding, and is hence admirably adapted for intense agriculture. Owing to the difficulty of communication, however, it is at present used almost solely for grazing, and nothing was more striking than to notice the almost entire absence of any cultivation, and the almost complete absence of any storage of fodder. This is the more remarkable, since last * summer famine prices were being paid for fodder in order to keep the stock alive. In some parts the herbage was so tall and luxuriant as to make it difficult to understand why none is cut and dried as English hay. In addition, many of the pasture plants common throughout these fertile valleys are not of the very first rank. For instance, white clover is comparatively scarce, red clover and lucerne practically absent, and none of the very best pasture grasses can be said to be as abundant as they might be. Perhaps, the commonest of the pasture plants are, on the whole, burr-medick, barley grass, mouse-ear chickweed, festuca bromoides, cape weed, flatweed, and—thistles. In some parts subterranean clover occurs, and a few native fodder plants. Kangaroo grass is scarce, but wallaby grass is fairly common. Perhaps one of the most striking features on these flats is the way in which the removal of the native redgum and the presence of stock have driven out the native flora, and caused it to be replaced by introduced pasture plants and weeds. A few of the native plants, however, appear to hold their own, such as Craspedia ("Billy Buttons"), Brunonia ("Blue Pincushion"), and the two native Acaenas, "Sheep's Burr" and "Bidgee Widgee," while in wet places the Bladderwort (*Utricularia*), and on the drier foothills the "Bluebell" (*Wahlenbergia*), *Daucus brachiatus*, the austral carrot, and a few of the smaller native compositæ easily hold their own.

This is one of the districts in which great stress is laid upon the fodder value of thistles in time of drought. The Shore Thistle, *Carduus pycnocephalus*, is perhaps the commonest plant in the whole district, and it grows abundantly not only on the river flats but also

* 1911.

up the hillsides to elevations of over 1,000 feet. Several acres of this thistle in different parts were closely examined where horses and cattle were grazing, but without finding any signs of a single thistle plant having been eaten. Occasional plants were trampled down, but not otherwise touched; and, in many cases where the animals appeared to be actually eating thistles, close examination showed that they were picking out the grass from around them and leaving the thistles untouched. Exactly the same was noted where sheep were grazing in a pasture containing thistles, but with plenty of rich grass and clover. Where the grass had been cropped short the sheep began to eat the heads of the thistles; but, in spite of the fact that the previous year had been a so-called drought season, it was possible to find plenty of dead thistle stems with shrivelled leaves attached on grazed pasture land. Apparently, therefore, stock provided with high-grade pasture plants do not eat thistles, except by accident; or in the same way that a man may take small quantities of non-nutritious condiments with his food. Sheep appear to attack shore thistle before cattle and horses do, but they can only be said to turn their attention properly to it when compelled by the scarcity of suitable fodder plants. If the place of the thistles was taken by herbage which could be converted into dry fodder, the gain in carrying capacity would be very great, and the "drought" danger—or, rather, starvation danger—would be correspondingly decreased.

The "Variegated Thistle," *Carduus Marianus,* is fairly abundant both along the roadsides and along the river flats. Its leaves appear to be more readily eaten by stock than those of the shore thistle, and it is perhaps the nearest approach to a fodder plant of any thistle. The richness of the soil is well shown by the fact that it may attain a height of as much as 10 feet, its thick woody stem forming a litter of trash on the ground after flowering. The area of ground occupied by this plant would probably have some 20 or 40 times the carrying capacity if occupied by, say, lucerne, under irrigation. Occasional plants of the Spear Thistle, *Carduus lanceolatus* were found, but this thistle—which is the most obnoxious of the three mentioned—is fortunately not very abundant, and the land-owners do not seem to encourage its spread.

In connexion with the claim so frequently made as to the fodder value of thistles, one fact is worthy of notice. It can frequently be seen in the neighbourhood of rabbit-warrens that every good pasture plant has been eaten out, and only a few obnoxious weeds left. In some cases the plants so left consist entirely of thistles, such as the shore thistle, spear thistle, star thistle, &c. It is certainly curious that rabbits, which are good judges of fodder, should leave them severely alone so long as they have anything else to eat. Plants such as the shore, variegated, and spear thistles may be, in a metaphorical sense, regarded as consisting of small portions of inferior fodder, protected by a natural investment of barbed wire. No farmer would knowingly feed his stock upon inferior chaff mixed with chopped barbed wire, and yet to some extent a diet of thistles corresponds to this. Of course, all plants popularly known as thistles are not alike, and while no one would claim the star and saffron thistles as fodder plants, many

persistently uphold the fodder value of the spear, shore, and variegated thistles. The so-called Sow Thistle, *Sonchus oleraceus*, is strictly speaking not a thistle at all, and is in any case not a thistle under the Act. Both rabbits and stock eat this plant freely, so that in pastures it is often eaten out, and is rarely able to become abundant.

There is one part of all thistles which has a certain food value, namely, the seeds, which strictly speaking are one-seeded fruits. These contain a good deal of nourishment, relatively almost as much in fact as the sunflower seeds, but their small size and the difficulty of collecting them prevents them having any economic value. They afford food, however, for many seed-eating birds; and it is generally considered that in New Zealand sparrows, by eating the seed of the variegated thistle, played an important part in keeping down this plant in districts where it had established itself. At the same time, by dropping occasional undigested seed, they may have helped in carrying it to districts where it did not previously grow. In Victoria, so far as is known hitherto, birds do not seem to have played any pronounced part in either keeping down thistles or in encouraging their spread. At Walwa, on the Upper Murray, starlings have recently appeared, and seem to be increasing in numbers rapidly. Although primarily insect and fruit eaters, these birds, like sparrows, seem ready to turn their attention to anything capable of being swallowed, and it will be interesting to notice in the future whether they exercise any influence upon thistles or other weeds of the district.

Among the commoner weeds along the Upper Murray a few are worthy of special mention. The Flatweed, *Hypochaeris radicata*, is very common, but is hardly to be classed as a serious weed. Several species of dock are, however, abundant, and some of the river flats are completely overrun with sorrel. Both of these are serious weeds, and can only be eradicated when fully established by thorough and cleanly cultivation. In the case of the docks, cutting before flowering prevents further spread, but has no perceptible effect upon the individual plants when once established. Cape weed is fairly abundant, and appears to have spread up the valley along the roadsides and thence run into the pastures. Paterson's Curse, *Echium violaceum*, is abundant in many parts below Walwa, and has also appeared higher up the river, where there seems to be a danger of it spreading. The Shepherd's Purse, *Capsella Bursa-pastoris*, is fairly common, but not sufficiently so as to be troublesome. The same applies to the common mallow which occurs occasionally near houses, and to the Hedge Mustard, *Sisymbrium officinale*, of which occasional plants or clusters of plants are to be seen. The bracken fern occurs in various parts, and, although it is not abundant, on a large amount of the land from which the timber has been cleared it will be very apt to spread and become a pest in future years if not kept down. The little purple tipped flowers of Bartsia showed almost everywhere among the pastures, and as this plant is parasitic on the roots of the grass, causing it to weaken or die out for a time, it very seriously deteriorates the carrying capacity of pastures in which it is abundant. It can only be destroyed by bringing the pasture under cultivation for a

time. A curious point in regard to distribution which was noted on several occasions was the occurrence of nettles on the tops of the cleared hills, but not on their sides or in the valleys below; and this in spite of the fact that they had evidently suffered somewhat from exposure to recent cold winds. The shore thistle also was often more abundant and taller on the tops of cleared hills than on the sides. This may possibly be partly due to the fact that sheep and other animals usually prefer to feed on the sheltered side of a hill, rather than on the exposed top.

One weed that might have been expected to be abundant, but which has evidently been kept down very successfully, is the Sweet Briar, *Rosa rubiginosa*, and the land-owners seem for the most part aware of the danger of allowing the plant to spread. It is scarce or absent on the pastures, and only an occasional clump occurs here and there in some of the gullies. All such plants should, of course, be destroyed, since the seed are continually carried by birds on to the pastures. At Jingellic, on the New South Wales side of the river, the sweet briar is very abundant, and is apparently spreading freely. This is, of course, bound to be a constant source of infection to the pastures on the Victorian side of the river.

Modiola multifida, "The Red-flowered Creeping Mallow," which is practically a useless pasture weed, appears to be spreading and increasing along the pastures on the Upper Murray, above Thologolong. Very common and conspicuous in the pastures and along the roadsides were the tall spikes of the yellow-flowered *Verbascum Blattaria*, "The Spurious Mullein," which is one of the oldest of our naturalized aliens, while *Stachys arvensis*, "The Wound-wart or Stagger Weed," which is also an early introduction, is fairly common in many parts. Two recently introduced weeds appear now to be fairly common. Thus *Tunica prolifica*, "Productive Carnation," first recorded in 1903, grows in several places, and especially at Mount Alfred, near Walwa; while *Linaria Pelisseriana*, "Pelisser's Toad Flax," grows in fair abundance at Guy's Forest, and at various localities along the Upper Murray, Corryong, and Cudgewa valleys. Since some species of *Linaria* have recently been shown to be capable of exercising a poisoning action on stock, the spread of this plant, in spite of its delicate spurred blue flowers and elegant appearance, is to be looked on with suspicion.

Along the whole valley, in spite of a careful search, and excluding some of the more rocky parts, which were difficult of access to stock, I was not able to find a single seedling of "Currajong," *Brachychiton populneus;* and if any seedling redgums occurred on the river flats grazed by stock, they were exceedingly few in numbers, and the majority of the redgums had apparently died of old age without any others taking their place. Since the currajong forms a valuable fodder reserve in time of scarcity, self-interest alone should show the desirability of preserving this valuable and interesting tree, which is rapidly in process of extinction. The tree grows readily from seed, and all that is necessary to re-establish it is to fence off small areas where a few trees are growing and scatter the seed over the ground.

"The Weeping Willow," *Salix Babylonica*, is planted in many places, particularly on the banks of the river and smaller streams. The leaves and young branches of this tree are eaten readily by stock, so that it acts as a fodder reserve, although only a poor one in comparison with a good hayrick or lucerne stack. The value of this tree in preventing the erosion of the banks is very great. Throughout the whole district numerous instances occur where the timber has been cleared away from the steep rocky hillsides, with the result that each rainfall rushes rapidly off the surface, carrying down the soil covering, and the sudden rush of water in the creeks causes them to eat steadily upwards into the hillside. The latter can be stopped to some extent by planting willows along their banks, but of course the planting must be done before the whole of the soil is washed away.

One point worthy of mention, though hardly a botanical matter, is in regard to the tin mine recently established at Walwa, and apparently about to rapidly increase in size. As at present arranged, the tailings from the stamps run on to the flood plain of the Murray and are reached by the water when the river is in flood. The tailings appear to set fairly hard in dry weather, but in wet weather would be carried away with the river. Since there is an intention of putting a weir across the river lower down, it would be a serious matter if the tailings flowed down the river in quantities sufficient to fill up the weir, or to decrease its capacity soon after it was formed. It would be a simple matter as things are at present to move the stamps further inland, and to allow the tailings to be deposited behind screens of brushwood, so as to avoid any danger to the river.

The general impressions one receives from the district as a whole, apart from the variety and beauty of the scenery and the frequency of running streams of water, are the extreme fertility of the plains forming the valley system, and the comparatively small agricultural use to which this mine of potential wealth has as yet been put. With better communication the plough will come more frequently into use, and with the plough a more numerous population and the higher forms of agriculture should develop.

ORCHARD AND GARDEN NOTES.

E. E. Pescott, F.R.H.S., Principal, School of Horticulture, Burnley.

The Orchard.

SPRAYING.

The peach aphis will now have made its appearance in orchards which were not sprayed with the red oil emulsion in the winter. The tobacco solution will now be required, and this may be sprayed on as strongly as the grower wishes. If possible, the spraying should be repeated quickly after the first operation, so as to kill any aphides previously protected by the others, or any that may have only been weakened by the first operation.

The time has also arrived when spraying is needful for the prevention of all fungus diseases, such as shothole or scab, black spot, leaf rust, leaf curl, &c. In the case of these pests. "prevention is better than cure" is the invariable rule: and to delay beyond the correct period the application of the necessary sprays is to court disaster. For black spot of apple and pear, the spraying should be performed as soon as the earliest flowers are opening. For shothole and scab, the time to spray is before the flower petals expand; and the spraying may be repeated, if necessary, after the fruit has set.

For rust and leaf curl, the spray should be applied before any sign of trouble appears on the foliage; thus, if the fungus were present during the previous season, it will be necessary to spray early to combat it successfully.

The basis of all successful fungicides is sulphate of copper or bluestone. Bordeaux mixture, a mixture of bluestone, lime, and water, known as the 6—4—40 formula, is used; the materials and quantities being 6 lbs. bluestone, 4 lbs. lime, and 40 gallons of water.

Another spray, and in some locations equally as successful in its results as the Bordeaux mixture, is the copper-soda spray, the proportions being 6 lbs. of bluestone, 8 lbs. washing soda, and 50 gallons of water. *In each case, the materials should be separately dissolved, and then evenly and simultaneously mixed in a third vessel.*

It is very important that the lime should be thoroughly fresh and quick, otherwise the spray mixture will give very inferior results. A second necessary point is that the copper sprays should be used as soon as they are made. Where any difficulties are experienced, or where the grower does not wish to make his own spray, there are quite a number of ready-made Bordeaux pastes and Bordeaux mixtures already on the market, which can be used with satisfactory results. In fact. the use of these has become fairly general, and it is not now the practice for growers to make their own sprays.

GENERAL.

Grafting should be carried out at once, whether for young trees or for re-working old ones. In connexion with this work, it is wise to cut back the trees some time before the operation is performed. Then, when the grafting is carried out, the dead ends may be cut off, and the grafts inserted in the new cuts. If the ground is at all warm, all varieties of citrus trees may be planted. The soil requires to be very sweet and well drained

CULTIVATION.

That the season is an extremely early one has been shown right throughout the State. At the Burnley Gardens, the Chinese Sand pear, which is generally in full bloom about the middle of August, was in full bloom in the middle of July. Other early-blooming fruit trees have also come into flower much earlier than previously. It is, therefore, most important that ploughing should be completed as early as possible. In the past, it has very frequently happened that, owing to delaying the ploughing, the orchard and the fruit crop have both suffered very considerably. It is absolutely necessary to cultivate the surface early, to take advantage of the moist surface and consequent easy ploughing, and also to conserve as large an amount of moisture in the soil as possible. The longer the ploughing is delayed, the less amount of moisture is retained in the soil for summer use. Deferred ploughing certainly means dry soil, enfeebled trees, and diminished results. Early ploughing gives exactly opposite results; the earlier the ploughing, the more soil-water is conserved.

When the ploughing is completed, the clods should be crushed, and the land harrowed, so that a fine earth mulch may be obtained. The orchard surface should be kept as level as possible, and no irregular ridging or furrows should be allowed.

All cover crops planted to supply humus to the soil should now be ploughed in. If the plants are of a leguminous nature, the best time to plough these in is when they are in full flower. If the growth has been at all excessive or rank, the crop may be rolled before ploughing, or it may be mowed or cut with a mowing machine. Every care should be taken that the plants will be well distributed throughout the soil, and large quantities in a mass should not be ploughed under. Artificial and stable manures may also be given to the trees at this time. These should be applied before ploughing.

Vegetable Garden.

The vegetable plots should be cleaned from all weeds, having the light weeds dug in, and the stronger ones pulled out and rotted in the compost heap. The surface should be worked up to a very fine tilth after digging; it must be kept constantly loose with the hoe to keep the soil cool; and prior to digging it will be advantageous to give a top dressing of lime.

If the weather be dry or windy, all newly-planted plants should be frequently watered. In transplanting seedlings, it is a help to dip the whole plant in water before planting.

Any seedlings that are ready may be planted out; tomato plants may be planted out under shelter until the frosts are over. At the end of the month a sowing of French bean seeds may be made. Seeds of peas, broad beans, beet, cabbage, Kohl rabi, radish, turnip, cauliflower, lettuce, carrot, parsnip, &c., may be sown in the open. Seeds of melons, cucumbers, pumpkins, marrows, and similar plants may be planted in frames for transplanting after the frosts have gone.

Flower Garden.

After digging, the surface must be kept constantly stirred with the hoe, so as to have it loose and friable for cooling and for moisture-conserving purposes. All weeds must be kept down, as they are robbers of plant food and moisture at this season of the year. Shrubs of all kinds may still be planted out, and these should be well watered after planting.

Rose and other aphides must be watched for, and treated according to instructions given in last month's notes. Rose scale should be sprayed with lime-sulphur wash, or with kerosene emulsion. This pest will soon disappear if the bushes are kept open to admit the air and the sunlight freely. Rose mildew will now be appearing, and the plants, as well as the soil, should be sprinkled with liberal dustings of sulphur. Sulphide of potassium is also a good specific for this fungus trouble, using it at the rate of 1 ounce to 3 gallons of water.

Cannas, early chrysanthemums, and early dahlia tubers may be planted out, as well as all kinds of herbaceous plants, such as delphiniums, perennial phlox, asters, &c. The clumps of these should be well divided, and in planting they should be fed with a liberal quantity of stable manure. Beds should be prepared and well dug over for exhibition chrysanthemums and dahlias.

Wattles of all kinds may be planted out, and many of these are suitable for garden work. For trees, *Acacia Baileyana* (Cootamundra), *A. saligna* (West Australian willow wattle), *A spectabilis* (weeping), *A. verniciflua, A. prominens, A. leprosa, A. longifolia, A. cultriformis, A. elata, A. decurrens,* variety *normalis, A. linifolia, A. iteaphylla, A. Maidenii, and A. retinodes* are all useful. While as shrubs, the following may be grown:—*A. discolor, A. longifolia,* variety *sophoræ, A. suaveolens, A. Farnesiana, A. myrtifolia, A. acinacea, A. Mitchelli,* and *A. podylarifolia.*

Acacias may be readily pruned, the work being done after flowering; and if this work be commenced when the plants are fairly young, they may be trained into beautiful and shapely bushes and trees.

It is also a good time to sow the seed. The outer covering of Acacia seeds is very hard, and the growing root is not able of its own accord to penetrate it. The seed must, therefore, be immersed for a few moments in boiling water, and allowed to soak for at least twelve hours. After this, they may be planted direct into the garden or into pots for subsequent transplanting.

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913–14.

Commencing 15*th April*, 1913.

CONDUCTED AT BURNLEY HORTICULTURAL SCHOOL.

No. of Pen.	Breed.	Name of Owner.	Eggs laid during Competition. April 15 to July 14.	July 15 to Aug. 14.	Total to date—4 months.	Position in Competition.
23	White Leghorns ..	J. H. Gill	381	152	533	1
61	.. ..	Jno. Campbell ..	350	131	481	2
65	.. ..	E. A. Lawson ..	361	119	480	3
48	.. ..	Thirkell and Smith ..	342	130	472	4
6	.. ..	J. S. Spotswood ..	358	111	469	5
11	.. ..	C. J. Beatty ..	333	132	465	6
8	.. ..	E. H. Bridge ..	334	127	461	7
68	.. ..	Jones and Curtis ..	313	125	438	8
16	Black Orpingtons ..	D. Fisher	306	130	436	9
31	White Leghorns ..	W. G. Swift ..	309	127	436	
46	Black Orpingtons ..	T. W. Coto	325	110	435	11
10	White Leghorns ..	T. A. Pettigrove ..	302	132	434	12
21	.. ..	A. Ross	322	98	420	13
35	.. ..	Moritz Bros. ..	290	127	417	14
34	.. ..	J. E. Bradley ..	301	114	415	15
50	.. ..	A. H. Mould ..	303	111	414	16
49	.. ..	M. H. Noye ..	271	128	399	17
66	.. ..	W. Featherstone ..	283	110	393	18
37	.. ..	C. H. Busst ..	274	117	391	19
7	.. ..	H. McKenzie ..	275	114	389	20
47	.. ..	W. McLister ..	269	106	375	21
26	.. ..	B. Rolls	244	130	374	22
40	.. ..	Geo. Edwards ..	272	100	372	23
32	.. ..	*H. Hanbury* ..	252	118	370	24
43	.. ..	Morgan and Watson ..	254	113	367	25
20	.. ..	C. B. Bertelsmeier ..	246	119	365	26
2	.. ..	R. W. Pope ..	261	95	356	27
41	.. ..	Percy Walker ..	245	111	356	
63	.. ..	A. Sellers	248	107	355	29
39	.. ..	W. Purvis	248	106	354	30
13	Black Orpingtons ..	T. S. Dallimore ..	233	118	351	31
58	White Leghorns ..	Stranks Bros. ..	235	114	349	32
5	.. ..	G. W. Robbins ..	213	132	345	33
67	.. ..	C. Hepburn ..	237	107	344	34
24	.. ..	Redfern Poultry Farm	230	114	344	
38	.. ..	M. A. Monk ..	241	101	342	36
14	.. ..	F. Hannaford ..	258	80	338	37
25	Black Orpingtons ..	King and Watson ..	240	97	337	38
45	White Leghorns ..	D. Gouddie ..	235	98	333	39
59	S.C.White Leghorns	Cowan Bros. ..	204	114	318	40
27	White Leghorns ..	J. Sinclair	225	87	312	41
3	.. ..	S. Buscumb ..	212	99	311	42
18	.. ..	*B. Rowlinson* ..	227	84	311	
55	.. ..	P. H. Killeen ..	191	114	305	44
52	.. ..	W. G. Osborne ..	183	117	300	45
62	.. ..	G. A. Gent ..	177	108	285	46
22	.. ..	B. Mitchell ..	201	84	285	
42	.. ..	A. Stringer ..	148	127	275	48
33	.. ..	South Yan Yean Poultry Farm	151	122	273	49
17	R.C.Brown Leghorns	S. P. Giles	164	96	260	50
44	White Leghorns ..	W. A. Bennie ..	152	108	260	
53	Black Orpingtons ..	A. Greenhalgh ..	182	76	258	52
57	White Leghorns ..	Glendell Bros. ..	165	91	256	53
56	.. ..	Schaefer Bros. ..	142	112	254	54
12	.. ..	A. H. Padman ..	156	92	248	55
19	.. ..	W. Dunlop ..	154	89	243	56
51	Black Spanish ..	W. H. Steer ..	121	122	243	
36	White Leghorns ..	A. J. Jones	118	119	237	58
28	.. ..	E. Waldon ..	182	54	236	50
54	.. ..	Jas. McAllan ..	99	133	232	60
64	*Golden Wyandottes*	*C. L. Sharman* ..	97	94	191	61
29	White Leghorns ..	S. Brundrett ..	89	100	189	62
15	.. ..	J. Shaw	109	80	189	
30	Black Orpingtons ..	Jas. Ogden ..	94	83	177	64
60	Black Spanish ..	Watson and Rushworth	69	96	165	65
4	White Leghorns ..	Jas. Brigdon ..	57	94	151	66
9	.. ..	Sylvania Stud Farm ..	78	54	132	67
		Total	15,131	7,260	22,391	

THIRD VICTORIAN EGG-LAYING COMPETITION, 1913-14.

MONTHLY REPORT ENDING 14TH AUGUST.

The past month concluded the winter test, and the output of eggs has been very satisfactory. For the first four months, 22,491 eggs have been laid by 402 birds, an increase of 1,299 eggs above that of the previous competition of 414 birds.

The weather for the month under review has been mild compared with last year, the temperature on only three occasions being 30 degrees, or thereabouts. Extremely cold and strong north winds have been experienced for days in succession, from which the birds took shelter very much.

The rainfall has been low, only 82 points being recorded at the pens for the month. Last year 225 points of rain fell during the same period.

The winners of the Winter Test (Gill, pen 23) have established a record for the Commonwealth by laying 533 eggs in four months, which is a splendid performance, and 53 eggs above the winners of last year's winter test. The second prize winner's (Campbell, pen 61) total was 481 eggs, one above Lawson's (pen 65).

The feeding in the morning was similar to that of the former month, but a slight increase of maize and pollard, when the cold north winds were experienced. At night, the ration consisted of wheat and cracked maize in equal parts, varied, in mild weather, by an increased proportion of wheat. The green food consisted of grass, thistles, &c., with an occasional supply of green lucerne.

The general health of the birds still continues excellent, all looking bright and vigorous.

REMINDERS FOR OCTOBER.

LIVE STOCK.

HORSES.—Continue to feed stabled horses well; add a ration of greenstuff. Rug at night. Continue hay or straw, chaffed or whole, to grass-fed horses Feed old and badly-conditioned horses liberally. If too fat, mares in foal should be put on poorer pasture.

CATTLE.—Except on rare occasions, rugs may now be used on cows at night only. Continue giving hay or straw. Be prepared for milk fever. Read article in *Year-Book of Agriculture*, 1905, page 314. Give calves a warm dry shed and a good grass run. Continue giving milk at blood heat to calves. Be careful to keep utensils clean, or diarrhœa will result. Do not give too much milk at a time for the same reason. Give half a cup of limewater in the milk to each calf, also place oats or lucerne hay in a trough so that they can eat at will.

PIGS.—Supply plenty of bedding in warm well-ventilated styes. Keep styes clean and dry, and feeding troughs clean and wholesome. Sows may now be turned into grass run.

SHEEP.—Avoid excessive dust in yarding sheep for shearing. Well bred fleeces free from dust and burr should be skirted carefully, the better the class of wool the greater the need. Fleeces that are dry and earthy on the backs need only stains removing, there is no advantage in removing burr on

these. It is better management to have ample table room, and extra men skirting carefully, than to hurriedly tear off unnecessary wool and then employ men at the piece table to sort what is known as "broken fleece" or "first pieces." All stains must come off fleeces, and weather stains from bellies. With crossbreds, separate all coarse fleeces from the finer sorts; and, with merinoes, the yellow and mushy ones from the shafty and bright. Skirt off any rough thighs from crossbred fleeces and keep separate. Press in neat bales; avoid "sewdowns." Brand neatly. If any likelihood of lambs not going for export before dry feed comes, shear at once.

Poultry.—The bulk of incubation should cease this month—late chickens are not profitable. Devote attention to the chickens already hatched; do not overcrowd. Feed with dry mash. Also add plenty of green food to ration, ordinary feeding to be 2 parts pollard, 1 part bran, a little dry bonemeal. Give a little three or four times a day, according to age. Feed crushed wheat or hulled oats at night. Avoid whole oats. Grit or coarse sand should be available at all times. Variety of food is important to growing chicks; insect life aids growth. Remove brooders to new ground as often as possible; tainted ground will retard development.

CULTIVATION.

Farm.—Plant main crops of potatoes in early districts and prepare land for main crop in late districts. Fallow and work early fallow. Sow maize and millets where frosts are not late, also mangolds, beet, carrots, and turnips. Sow tobacco beds and keep covered with straw or hessian.

Orchard.—Ploughing and cultivating to be continued, bringing surface to a good tilth, and suppressing all weeds. Spray with nicotine solution for peach aphis, with Bordeaux mixture for black spot of apple and pear, and with arsenate of lead for codlin moth in early districts.

Vegetable Garden.—Sow seeds of carrot, turnip, parsnip, cabbage, peas, French beans, tomato, celery, radish, marrow, and pumpkins. Plant out seedlings from former sowings. Keep the surface well pulverized.

Flower Garden.—Keep the weeds down and the soil open by continued hoeing. Plant out delphiniums, chrysanthemums, salvia, early dahlias, &c. Prepare ground for digging and manuring for autumn dahlias. Plant gladioli tubers and seeds of tender annuals. Spray roses for aphis and mildew.

Vineyard.—This is the best month for field grafting. If stocks bleed too copiously, cut off 24 hours before grafting. Field grafts *must* be staked, to avoid subsequent straining by wind and to insure straight stem for future vine. Stakes are also necessary for grafting rootlings for same reasons. Temporary stakes 3 feet long will suffice. Keep a sharp look out for cut worms. (See *Journal* for July, 1911, and also current issue.) Disbud and tie up all vines, giving special care to young plantations. Beware of spring frosts. (See *Journal* for September, 1910.)

Conclude spring cultivation (second ploughing or scarifying and digging or hoeing round vines). Weeds must be mastered and whole surface got into good tilth. Sulphur vines when shoots 4 to 6 inches long.

Cellar.—Taste all young wines; beware of dangerous symptoms in unfortified fruity wines, which may need treatment. Fill up regularly all unfortified wines.